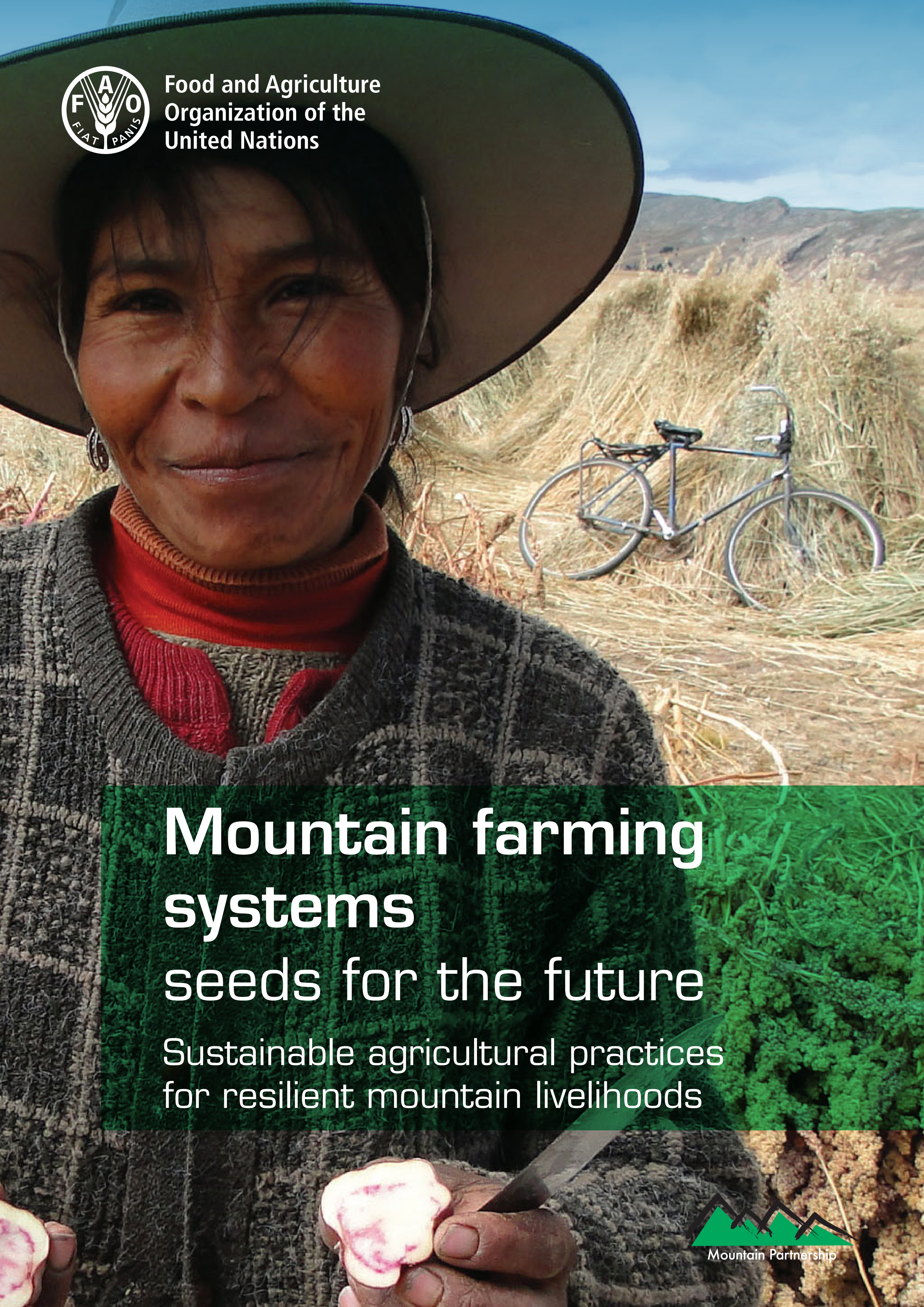

Food and Agriculture
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Mountain farming systems

seeds for the future

Sustainable agricultural practices for resilient mountain livelihoods

Mountain Partnership

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Cover photograph: Woman farmer in the Peruvian Andes displays her harvest of quinoa and potatoes
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Mountain farming systems
seeds for the future

Sustainable agricultural practices for resilient mountain livelihoods

Food and Agriculture Organization of the United Nations

Rome, 2021

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Foreword

Agriculture and food processing are important economic and development drivers in many mountainous areas and are essential features of mountain landscapes, cultures and societies.

However, the majority of the world's mountain rural population does not have secure access to food and to the daily calories and protein necessary to guarantee a healthy life: one out of every two mountain dwellers in the rural areas of developing countries is estimated to be at risk of food insecurity.

The persistence and high incidence of vulnerability to food insecurity among the 1 billion people living in mountains in the developing countries is a matter of great concern and is hindering the achievement of Sustainable Development Goal 2 – zero hunger.

This publication has been compiled with the objective of raising awareness about the importance of applying sustainable production practices to mountain agriculture as an accelerator for achieving the 2030 Agenda for Sustainable Development. A joint initiative by the Food and Agriculture Organization of the United Nations, the Mountain Partnership Secretariat (MPS), the Swiss Federal Office for Agriculture and the Italian Development Cooperation, it also aims to contribute to the milestone UN Food Systems Summit in 2021.

Applying sustainable practices offers opportunities for mountain agriculture to balance economic development with cultural and environmental preservation. Special focus has been given to the potential of agroecological approaches for improving mountain people's livelihoods and creating environmental benefits. These environmental benefits include conservation of biodiversity, improved resilience to extreme events, and water management for highland populations as well as lowland populations living far away. Agroecological approaches can also help to tackle some of the vulnerabilities of the food system exposed by COVID-19 and to "build back better" after the pandemic.

The case studies presented in this publication clearly show the opportunities for empowerment – particularly of women – generated through the production of high-quality mountain products with strong market value, which can increase incomes for mountain communities. The case studies also emphasize the need at institutional level for policies, investments and cooperation that specifically target and support mountain people, their production systems and their incomes.

Mountain farming systems that have evolved under varying agroclimatic conditions – frequently in difficult and inaccessible terrains ill-suited to intensive, high-productivity crops – have often maintained a highly diversified genetic base for crops and domestic animals. This publication shows that sustainable approaches in mountain agriculture are varied, rich and dynamic, with innovative and traditional farming practices that are being tested, used and promoted by farmers, researchers, practitioners and policy makers. Such practices seek to protect biodiversity, improve resource efficiency, strengthen resilience and promote social equity, while enhancing the livelihoods of mountain communities.

Harnessing the potential of mountain farming systems is key to attracting youth back to agriculture and food-based livelihoods, and to ensuring that healthy mountain ecosystems can continue to provide their essential services. Our organizations are all deeply committed to sustainable mountain development. It is our hope that this publication will encourage others to join us in providing political support and investment for sustainable mountain agriculture and sustainable food systems for the future.

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Abbreviations and acronyms

CO_2-eq	carbon dioxide equivalent
CIP	International Potato Center
DFF	Decade of Family Farming
FAO	Food and Agriculture Organization of the United Nations
FFF	Forest and Farm Facility
FFPO	forest and farm producer organization
FOD Bio-KG	Federation of Organic Development BIO-Kyrgyzstan
FSF	Future Smart Foods
GEF	Global Environment Facility
GHG	greenhouse gas
GIAHS	Globally Important Agricultural Heritage System
ICIMOD	International Centre for Integrated Mountain Development
ICRAF	World Agroforestry Centre
LEK	local ecological knowledge
MAP	medicinal and aromatic plant
MP	Mountain Partnership
MPP	Mountain Partnership Products
MPS	Mountain Partnership Secretariat
NGO	non-governmental organization
NUS	neglected and underutilized species
PGI:	protected geographical indication
POP	package of practices
PGS	Participatory Guarantee System
PKVY	Paramparagat Krishi Vikas Yojana
SDG	Sustainable Development Goal
TEBTEBBA	Indigenous Peoples’ International Centre for Policy Research and Education
TMI	The Mountain Institute
UNEP	United Nations Environment Programme
UNWTO	United Nations World Tourism Organization
VNFU	Viet Nam Farmers Union
WNEP	Wild and non-cultivated edible plant

Executive summary

Mountains cover about 27 percent of the Earth's land surface and are found on all continents. Agriculture is a predominant economic activity in mountain areas and an essential feature of mountain landscapes and peoples' cultures and societies.

Mountain farming systems have the potential to support sustainable mountain development and drive progress towards several of the Sustainable Development Goals, particularly the goals of reducing rural poverty, contributing to zero hunger, reducing gender inequalities, ensuring the availability and sustainable management of water, and protecting key terrestrial ecosystems.

Mountain communities have developed valuable traditional knowledge and practices in crop cultivation, livestock production, water harvesting, forestry and agroforestry that are well adapted to natural ecosystems and biological cycles. Demographic shifts, changes in consumption trends and markets for agricultural products, and the effects of climate change are altering the way that mountain farming is traditionally carried out. These changes may create opportunities but can also have negative consequences for the livelihoods of mountain peoples, and for mountain ecosystems.

This publication presents a collection of case studies provided by Mountain Partnership (MP) members from around the world, highlighting experiences of agroecological mountain farming systems. It aims to increase attention toward agroecological principles and approaches and their potential. The MP, the only United Nations global voluntary alliance dedicated to sustainable mountain development, is fully committed to promoting action that can improve the resilience of mountain people and environments.

In mountains, the practice of agroecology can result in more resilient agricultural and food systems. Diversity is a fundamental element of agroecology that safeguards resilience, ecosystem functions and productivity at farm level as well as at market level. Agroecology is crucial for human health and nutrition because it embraces several context-specific approaches, organic practices, agroforestry and permaculture.

A common theme of the many projects and activities featured here is a strong human-centred approach, pointing to the importance of knowledge exchange, encouraging a sense of community, strengthening local initiatives, creating alliances and promoting a solidarity economy, for mountain agriculture and food systems.

Mountain agricultural products satisfy many of the demands of today's discerning consumers, who are often looking for healthy, organic and traditional products that tell the story of the communities behind them. Making value chains more efficient and sustainable through their shortening, diversification, conservation of traditional breeds and variety, along with improved marketing and labelling, are all opportunities for mountain agriculture. In territories where food culture and social values are prominent features, agritourism, ecotourism and community-based tourism also represent significant opportunities.

The experiences showcased in this publication demonstrate that the 10 Elements of Agroecology are highly relevant for mountain farming systems. These are:

- **diversity (1),** which improves mountain soil health and productivity and can also help to bolster nutrition and human health and market diversification, ultimately building resilience;

- **co-creation and sharing of knowledge processes (2)** that blend traditional and indigenous mountain knowledge, as well as producers' and traders' practical knowledge and global scientific knowledge;

- **synergies (3)** that contribute to enhancing key functions across food systems are particularly important in mountain contexts, where ecosystems are fragile and harmony between agriculture and nature is crucial – practices such as innovative high-biodiversity cropping systems (including animal integration and high-value crops) also reinforce other principles, such as **efficiency (4), recycling (5) and resilience (6);**

- **human and social values (7) and culture and food traditions (8)** can help to promote cultural preservation and sustainable mountain tourism development, and to foster the strong sense of belonging and traditions in mountains; and

- **responsible governance (9) and a circular and solidarity economy (10)** which can be considered as potential approaches to improving mountain economies that suffer from lack of investments, lack of access to infrastructure, markets, and lack of organized support.

Food security in mountains is a matter of concern, as current data on vulnerability to food insecurity (Romeo, *et al.*, 2020) show that half of all rural mountain people in developing countries live in areas where the daily availability of calories and protein is estimated to be below the minimum threshold needed for a healthy life.

Through adequate and coordinated pro-mountain policies, investments, capacity development, services and infrastructures, as well as efforts to provide smallholders and family farmers with access to innovation, mountain farming systems have the potential to become important pathways for change. In doing so, they can provide valuable support and impetus to the transition to sustainable food systems, contributing to revitalizing rural areas for youth and lifting mountain peoples out of poverty and hunger, while protecting fragile mountain environments for the future.

Introduction

Rosalaura Romeo, Sara Manuelli, Michelle Geringer and Valeria Barchiesi

About 27 percent of the Earth's land surface is covered by mountains. In mountain areas worldwide, agriculture is embedded in landscapes, cultures and societies, and it is crucial for mountain communities' subsistence.

Mountain farming is often carried out by families, and due to the multitude of agroecological zones resulting from altitude changes and varied landscapes, a wide genetic variety of agricultural crops and farm animals is generally found in mountain regions. Mountain people share a deep respect for nature, together with a holistic view of it, and as such, they are careful stewards of the often scarce natural resources that surround them.

However, food security in mountains has been a matter of concern in recent years. Half of all rural mountain people in developing countries live below the minimum threshold of available calories and proteins needed for a healthy life, as estimated by current data on vulnerability to food insecurity (Romeo, *et al.*, 2020).

Agroecology is a relevant basis for promoting well-functioning and sustainable food and agricultural systems. Agroecological practices may include organic farming, permaculture and agroforestry, and agroecology can include a multitude of sustainable solutions, applying localized knowledge-based practices, not only at field level, but also to the broader food system, including food processing, marketing and distribution. A key element of agroecology and mountain farming is diversity: it ensures the provision of ecosystem functions, productivity, resilience and market diversification, and contributes to human nutrition and health.

Based on an integrated approach that simultaneously applies ecological and social concepts and principles to the design and management of food and agricultural systems, agroecology puts people squarely at the centre of food systems (HLPE, 2019). Using a scientific basis of agroecological processes for food and agriculture systems, it provides holistic and long-term solutions based on knowledge sharing and innovation, including the combination of local, traditional, indigenous and practical knowledge with multidisciplinary science (FAO, 2019a).

Family farmers, including smallholder producers, indigenous people and pastoralists, are at the heart of agroecology. This publication is a compilation of experiences for sustainable agriculture in mountain areas, featuring examples of agroecological mountain farming systems from around the world through case studies provided by Mountain Partnership (MP) members. These highlight a rich array of projects, research, experiences and lessons learned on mountain food systems. They offer the perspectives of different stakeholders on the opportunities and challenges for agriculture in mountain areas, with a special focus on practices that can help to conserve local agrobiodiversity and enhance mountain peoples' resilience to environmental and economic changes.

The message from many of the experiences documented here is that traditional approaches to mountain farming have changed due to shifts in consumption and markets and due to the effects of climate and demographic changes. The consequences represent both opportunity for and a risk to mountain communities and ecosystems. The COVID-19 pandemic has amplified existing challenges faced by food systems in mountain areas, as evidenced by disruptions to food supply chains, food shortages in many developing countries and an increase in people suffering from acute food insecurity (FSIN, 2020; ICIMOD, 2020).

To address the growing challenges brought about by human activities and global changes, effective and specific mountain policies and coordinated interventions are needed at all levels, to conserve natural assets that support human well-being from the highlands to the lowlands, and ultimately to “ensure the conservation of mountain ecosystems” (SDG 15.4). In mountains, we can find the inspiration and innovation for a more sustainable and prosperous future.

Mountain agriculture in Kalikot, Karnali Province, Nepal
©Geeta Pandey

1

Mountain agriculture matters for sustainable development

1. Mountain agriculture matters for sustainable development

Rosalaura Romeo, Sara Manuelli, Michelle Geringer and Valeria Barchiesi

Throughout the centuries, mountain agriculture has contributed to shaping highland landscapes as we see them today. Mountains[1] are often harsh environments, remote and vulnerable to natural hazards. To cope with these conditions, mountain communities have developed valuable traditional knowledge and practices in crop cultivation, livestock production, water harvesting, forestry and agroforestry, which are well adapted to natural ecosystem biochemical cycles.

Agriculture is an important element of mountain landscapes and cultures and provides critical ecosystem services for upland and lowland environments. The Alpine Convention (2017) describes mountain agriculture as an essential resource for supplying food to the population, producing typical nutritious and high-quality products, preserving and maintaining the cultural landscape, including tourism, and protecting soil against erosion, avalanches and floods.

Mountains are key ecosystems, providing goods and services to the planet worldwide. They are often referred to as the "water towers" of the world for their role in the maintenance of freshwater reserves, and due to their topographical diversity, steep environmental gradients and climatic conditions, they host unique ecosystems.

Mountains cover more than one-quarter of the Earth's land surface and are home to 1.1 billion people, almost 15 percent of the world's population.

More than 90 percent of the world's mountain dwellers live in developing countries, including 648 million people in rural areas, where a vast majority live below the poverty line and one out of two people faces the threat of food insecurity. The number of rural mountain people in developing countries considered vulnerable to food insecurity was estimated at 346 million in 2017, an increase of more than 40 million since 2012, when they were estimated at roughly 300 million.

Mountainous areas host a rich variety of ecological systems and genetic diversity. Of the 20 plant species that supply 80 percent of the world's food, six (apples, barley, maize, potatoes, sorghum and tomatoes) originated in mountains, and a large proportion of domestic mammals (sheep, goats, yaks, llama and alpaca) originated or have been diversified in mountains.

About 50 percent of all global biodiversity hotspots are located in mountain regions (17 out of 34). These contribute disproportionally to the planet's terrestrial biodiversity and approximately 30 percent of total land identified as Key Biodiversity Areas is located in mountains. Mountain species coexist thanks to their different climate preferences and have high genetic diversity, which is a prerequisite for adaptation to new conditions.

Sources: Fleury, 1999; UNEP-WCMC, 2002; Chape *et al.*, 2008; Körner and Paulsen, 2004; Rahbek *et al.*, 2019 ; UNEP *et al.*, 2020; Romeo, *et al.*, 2020.

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[1] Definition of mountain by UNEP-WCMC: www.fao.org/mountain-partnership/about/definitions/en/

In many mountain areas, agricultural and food systems are key economic and development drivers, providing a source of income through products for local and urban markets, and employing a significant share of the population, especially in developing countries.

Traditional mountain farming systems have adapted to local circumstances through sophisticated techniques such as terrace farming, which has made farming in mountains possible and enables farmers to make their land more productive. These agricultural techniques play a role in sustaining entire ecosystems, as farming helps to stabilize the land and reduces soil erosion, preventing the leaching of nutrients.

A range of mountain farming systems has been developed in relation to specific varied climatic conditions, slope and elevation. They can be broadly classified as follows (El Solh, 2019):

- **Pastoral livestock production system:** This is a grazing-based production system, whereby livestock are fed on natural vegetation and rangelands that include grasses, legumes, shrubs and other vegetation, which provide forage throughout the year.

- **Agropastoral livestock system:** This is an integrated crop-livestock-rangeland production system that includes different types of livestock, natural pastures and various field crops such as barley, forage crops, shrubs and trees, as well as by-products of field crops.

- **Rainfed agriculture production system:** In both tropical and non-tropical areas, rainfed agriculture occurs where there is more than 400 mm of rainfall during the rainy season. Worldwide, rainfed agriculture is often used as a conservation agriculture approach, meaning minimum soil disturbance or zero tillage, stubble retention and crop rotation. Conserving soil moisture and reducing soil erosion in rainfed agriculture production systems are crucial to ensuring the sustainability of soil productivity, soil and water conservation.

- **Irrigated agriculture production system:** This system is practised in arid and semi-arid mountain areas, where annual rainfall is less than 350 mm. The sources of irrigation water are either deep artesian wells, surface water from rivers, or harvested rainwater in macro and micro water catchments and dams. Farmers using irrigated mountain agriculture production systems tend to diversify production to ensure food security, with high-value crops, including vegetables, fruit trees and ornamentals.

- **Forestry system** or **agroforestry:** This is an important source of livelihoods in mountain areas and provides essential environmental goods and services, such as timber, fuelwood, carbon storage and other products that improve the lives of people living in mountains.

Mountains offer unique opportunities for agriculture due to their variations in climate, soils, elevations and slope, resulting in much greater diversity in terms of species richness and degree of endemism. Since agricultural biodiversity is the basis for global food security, mountain agrobiodiversity should be considered as nature's insurance system.

In general, mountain agriculture is characterized by smaller, more fragmented plots of land compared with lowland agriculture, and by time-consuming and labour-intensive cultivation and pastoralism practices. For example, in the Hindu Kush Himalaya, households typically own less than 1 ha of land (Wester *et al.*, 2019). The highly diversified mountain livelihoods found here are based on a combination of agriculture, handicrafts, tourism and trade, full- or part-time.

The agroclimatic features of mountains have a number of implications for agriculture compared to agriculture practised on the plains. These include low productivity, low scale of economy, restrictions on monocropping, cold-resistance, integrated farming systems, and opportunities for mountain specialty products and off-season fruit production (FAO, 2019b). Widespread lack of investment exacerbates the negative aspects of mountain agriculture while failing to exploit its positive aspects.

Worldwide, mountain agriculture is changing under the pressure of population growth, rapid urbanization and climate change. Outmigration and land abandonment are among the most visible trends affecting traditional mountain farming systems. Male outmigration to urban areas is common in many rural

Himalayan landscape in India
©Pradeep Mehta

mountain regions, such as the Tropical Andes and the Hindu Kush Himalaya, with the result that responsibility for agriculture falls on women, adding to their workload. Women often face more obstacles than men in agricultural endeavours, including reduced access to land and finances, lack of decision-making power and high dependence on intermediaries (Bachmann *et al.*, 2019). In some regions of the developing world, urban encroachment on agricultural lands is one of the main drivers of reduced agricultural productivity. The transformation of integrated mountain farming systems to more input-intensive, higher-yield agriculture is occurring in many mountain regions, with often devastating impacts on natural resources and biodiversity.

Mountain agriculture, either as a subsistence or commercial activity, is particularly linked to water availability. Climate change is expected to affect this essential resource, with probable repercussions for agricultural activities. Predictions are that climate-related shifts will reduce water availability for irrigation, while increasing the risk of extreme weather events, including floods and droughts (IPCC, 2019). Such events would negatively impact crop yields and reduce areas suitable for cultivation. In recent years several mountain areas have experienced a reduction in water availability for crop irrigation and a subsequent decline in agricultural yields. Mountain meltwater is essential during the dry season, for agriculture and other human needs (Biemans *et al.*, 2019). It is estimated that the vulnerability of mountains to climatic and socio-economic changes linked to water could negatively affect 1.9 billion people living in, or directly downstream of, global mountainous areas (Immerzeel *et al.*, 2020).

The importance of mountain agriculture for achieving the SDGs

Under the framework of the United Nations 2030 Agenda and Sustainable Development Goals (SDGs), mountain agriculture has the potential to advance sustainable mountain development and strengthen the resilience of communities and ecosystems in mountain areas. Mountain agriculture contributes to the following SDGs:

SDG 1 – No poverty

Approximately 1 billion people live in the mountains of developing countries. Of these, around 648 million live in rural areas where poverty is widespread, often with a higher incidence of poverty than in surrounding lowlands. Mountain agriculture represents a source of income for mountain dwellers through ecotourism and the sale of speciality products.

SDG 2 – Zero hunger

Vulnerability to food insecurity is high in mountains. An estimated 1 out of 2 mountain people living in the rural areas of developing countries is vulnerable to food insecurity. Most of the world’s mountain chains are home to indigenous peoples and local communities, whose livelihood strategies, food systems and cultural identities are inextricably linked with mountain environments. Mountains are important centres of domestication of plants and therefore repositories of local varieties, providing a global gene pool that is critical for nutritional improvement, dietary diversity and quality.

Appropriate policies and investments in support of mountain agriculture could increase food production and contribute to food security for mountain people.

SDG 3 – Good health and well-being

Poverty and scarce access to food and medical facilities threaten the health of many people living in mountains. Water quality is highly dependent on mountain sources and on water management through farming practices.

Mountain agriculture is well suited to the production of a wide range of fruits, nuts, vegetables, livestock and by-products, and other high-value products (most of which are potentially Future Smart Foods) that could contribute to improved availability of sufficient, nutritious and safe food and address food shortages in mountain areas.

SDG 5 – Gender equality

Mountain women farmers often have primary responsibility for natural resource management, agricultural production and the well-being and survival of their families. Male outmigration, permanent or seasonal, leads to increased responsibilities and workloads for women in mountain agriculture. Achieving gender equality in mountain agriculture calls for targeted interventions to improve access to inputs and resources for women and eliminate discrimination against women and girls.

SDG 6 – Clean water and sanitation

This SDG aims to protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes. Mountain glaciers are retreating, while deforestation and unsustainable economic activities are increasing difficulties for some mountain communities in accessing clean water. Mountain agriculture can contribute to maintaining high water quality, both in uplands and lowlands, through appropriate farming and water management practices.

SDG 8 – Decent work and economic growth

Mountain areas can greatly contribute to the economy, while at the same time helping to conserve the natural heritage. Many economic sectors are based on mountain services and products, including tourism, forestry, agriculture, biodiversity conservation, pastures and pharmaceuticals.

Mountain products and agritourism generate income for smallholder farmers and improve local economies. Producer organizations have strong potential for inclusive economic growth through training in marketing and distribution techniques, as well as through improved access to markets.

SDG 12 – Responsible production and consumption

In some areas, the over-extraction or degradation of environmental resources represents a challenge for mountain agriculture, while in others, mountain farming practices are making a strong contribution to resource efficiency, waste reduction and keeping a low carbon footprint.

Mountains are at the forefront of sustainable production practices and agrobiodiversity conservation. Mountain tourism promotes sustainable food systems and responsible production and consumption by informing consumers of the nutritional value of agrobiodiverse products, focusing on domestic value chains that ensure transparency and trust between producers and consumers, and fair compensation for the primary producers.

SDG 13 – Climate action

Mountains are considered as early indicators of climate change. Mountain soils and grasslands are also good carbon sinks. Mountain agriculture is mainly rainfed, with little on-farm storage or irrigation capacity, and is strongly affected by climate change, as are mountain populations.

Mountain agriculture has the potential to build mountain peoples' resilience through the diversification of livelihood opportunities and the adoption of climate adaptation practices (such as promoting climate-resilient, economically viable and locally available or adaptable crops and farm animals).

SDG 15 – Life on land

Mountain agriculture is an essential element of mountain landscapes, cultures and societies. Good mountain agricultural practices enhance the role of mountains in the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services. The SDG target 15.4 is fundamental for sustainable mountain development and it seeks to, by 2030, "ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development."

SDG 17– Partnership

The Mountain Partnership is a United Nations voluntary alliance of partners dedicated to improving the lives of mountain peoples and protecting mountain environments around the world. Currently, more than 400 governments, intergovernmental organizations, major groups (e.g. civil society, non-governmental organizations [NGOs] and the private sector) and subnational authorities are members.

The MP brings members together to work towards a common goal: to improve the lives of mountain peoples and protect mountain environments worldwide.

Kyrgyz community in high mountains
©Kuluipa Akmatova

2

Key takeaways from experiences for sustainable agriculture in mountains

2. Key takeaways from experiences for sustainable agriculture in mountains

Rosalaura Romeo, Sara Manuelli, Michelle Geringer and Valeria Barchiesi

The examples of mountain farming systems and agroecological practices provided by MP members show the potential for mountain agriculture to balance resilience, livelihood improvement and economic development.

The remoteness of mountain farmers and their lack of financial resources often limit the use of pesticides and promote farming in an organic manner. In addition, family-based and small-scale upland farms, if not already organic, have strong potential for moving or reverting to organic practices relatively easily, compared with large-scale lowland businesses. (Wymann von Dach *et al.*, 2013)

Diversity, in terms of production systems, but also activities, can be considered and applied as a pathway towards environmental and socio-economic resilience, and as a livelihood strategy. Participatory Guarantee Systems (PGS) are a promising tool for mountain farmers to improve equity in value chains, and bring together producers and consumers. They highlight the importance of transparent transactions for mountain products and the role of community-based participation

Terrace farming in Karnali province, Nepal
©Ashim Poudel

as a valid system of certification. Thirty-eight percent of the world's mountain people live in urban areas, and urban gardening as well as ecological markets can be a way to engage local populations, bringing consumers and producers closer together, as well as making small plots of land highly productive.

Mountain people's livelihoods are at the core of many projects and initiatives in the experiences featured here, and a common theme is a strong human-centred approach. Culturally appropriate food systems are critical components of many case studies, due to their linkages with food security, nutrition and ecosystem health. Cultural identity shapes landscape and farming practices, which can in turn inspire agroecological solutions. The deep connection between human and social values, culture and food traditions in many of the case studies represents a strong sense of belonging in mountain areas, with promising potential in terms of sustainable tourism development. In territories where food culture and social values are prominent features, community-led tourism and diversification of activities represent a significant opportunity.

The following chart summarizes the main lessons learned from the case studies:

Knowledge exchange	Safeguarding agrobiodiversity and enhancing resilience	Producing more with less
The combination of traditional knowledge and innovation, and of research and community action, is key for successful experiences. Demonstration sites (Nepal), use of low-cost techniques and local materials, the understanding of social context (Kyrgyzstan, Peru), are all crucial to ensure the sustainability of policies and projects, through public-private partnerships and multi-stakeholder engagement.	Agrobiodiversity is a way to reduce risk – by using multiple varieties of the same species, the farmer protects the harvest against possible attack. The typically scattered nature of production in mountain areas and the great variety found there pose challenges in terms of producing large volumes, but have the advantage of conferring increased resilience. Agrobiodiversity is fundamental for water resource efficiency (Nepal), climate change resilience (Panama) and greenhouse gas reduction (Switzerland). It also contributes to improved nutrition and food security, is adaptable to small-scale farming and provides ecosystem services.	Efficiency in production, natural resource management – avoiding waste – and conservation of indigenous varieties is fundamental to achieving sustainable mountain development (India, United Republic of Tanzania). Terrace farming and permaculture principles such as rainwater harvesting, grey water harvesting, mulching and tree planting make it possible to cultivate under unfavourable land conditions and increase the efficient use of scarce resources. The farm is considered an organism integrated within an ecosystem (Nepal).
Adding value to products	**Encouraging a sense of community**	**A solidarity economy**
Adding value to speciality products can ensure fair prices for farmers and increase recognition for indigenous crops and lesser known wild edible plants for their nutritional and climate-resilient value (Plurinational State of Bolivia, Portugal, United Republic of Tanzania). Certification and product differentiation systems demonstrate the quality and diversity of products with transparency (India). A local territorial brand can promote interest in local crops and cultural heritage. This can help to safeguard important traditional crops, productive know-how and consumption rituals, and foster increased organic production (Switzerland).	The social aspect plays a pivotal role in co-creating knowledge, supporting other farmers, sharing technical expertise and recreating the linkages between humanity and the environment. Social exchanges are fundamental to rebuild consumer-producer linkages and those with citizens. Urban gardens can foster a renewed sense of community, and ensure healthier and adequate diets (Plurinational State of Bolivia). Mountains can promote a strong sense of collective spirit, as well as self-sufficiency and solidarity among residents, which can in turn inspire others (Portugal). Farmers in mountain areas were found to be naturally inclined to interact and help each other, avoiding an individualistic and competitive approach (Italy).	Connecting at an emotional level and understanding the risks of food production can create an inclusive and solidarity-based economy (Peru). The awareness of both producers and consumers regarding sustainable production and nutrition-sensitive products is increasing. This is a reciprocal process, where organic markets encourage the growth of organic producers, who then connect with other farmer groups and increase sustainable production (India, Thailand)

Strengthening local initiatives

Political support is fundamental for agricultural research and infrastructure development. Best practices can lead by example and move regulations forward (Plurinational State of Bolivia). Online decision-making tools can tailor recommendations based on farmers' individual needs (China). Examples include: the creation of a governing body and a special fund for family farming, to strengthen family farmers' organizations, the implementation of agritourism strategies, the construction of commercialization infrastructures and the improvement of access to information through technologies (Panama).

Creating alliances

Mountain farmers have very limited capacity to supply large volumes of products in order to meet market demand, but collectively they can do so and increase organic production (Kyrgyzstan). Community farming and collaborative market strategies can help to reverse migration flows and make territories more attractive. Collaboration at all levels is fundamental for the sustainability of projects, and local producer associations and institutions are often as important as national/regional authorities (Romania). Building alliances makes it possible to scale up and to link farmers with enterprises and markets, diversifying organic production and, at the same time, maintaining sustainable development as a priority (Viet Nam). There are also opportunities for transboundary collaboration, for example, to promote cardamom as a regional product through coordinated research, technology exchange for improved yields, building organized markets and infrastructure, and developing compatible regional policies (Nepal).

Combined actions

A multiscale, multiple-goal approach, integrating political, social and ecological factors, is fundamental to ensure the effectiveness of combined actions (Peru). For example, the use of renewable energy can relieve pressure on natural resources, while also saving money (Nepal, Sierra Leone). Organic and agroecological agriculture shows that achieving multiple complementary goals is possible: food security and decent employment can be related to water security of watersheds (Panama), as well as enhanced biodiversity and recognition of women's roles (United Republic of Tanzania). Geographical certification and territorial valorization are multidimensional and can achieve several goals at once, helping to mobilize resources, identify priorities and lobby for government support (Portugal, United Republic of Tanzania).

People-centred actions

Solutions to environmental and poverty-related problems will only be found by working together with people, and if those people are ready to put them in place (Morocco). Interventions must be adapted to people's needs and cultural beliefs and traditions. The role of resource persons is crucial in connecting and creating a bridge among sectors and institutions (Italy), or among types of knowledge. Strengthening local partners and training local staff as primary implementers is a successful way of keeping programme staffing levels small and cost-effective, while expanding the reach to remote communities, ensuring long-term sustainability for projects (Nepal). Communities need to be empowered to lead with autonomy; local and indigenous people must be involved in conservation, because they are both guardians and users of resources (Peru, the Philippines). Farm household resources influence the capacity to pursue different livelihood strategies; context-specific people-centred policies are the pathway towards sustainability.

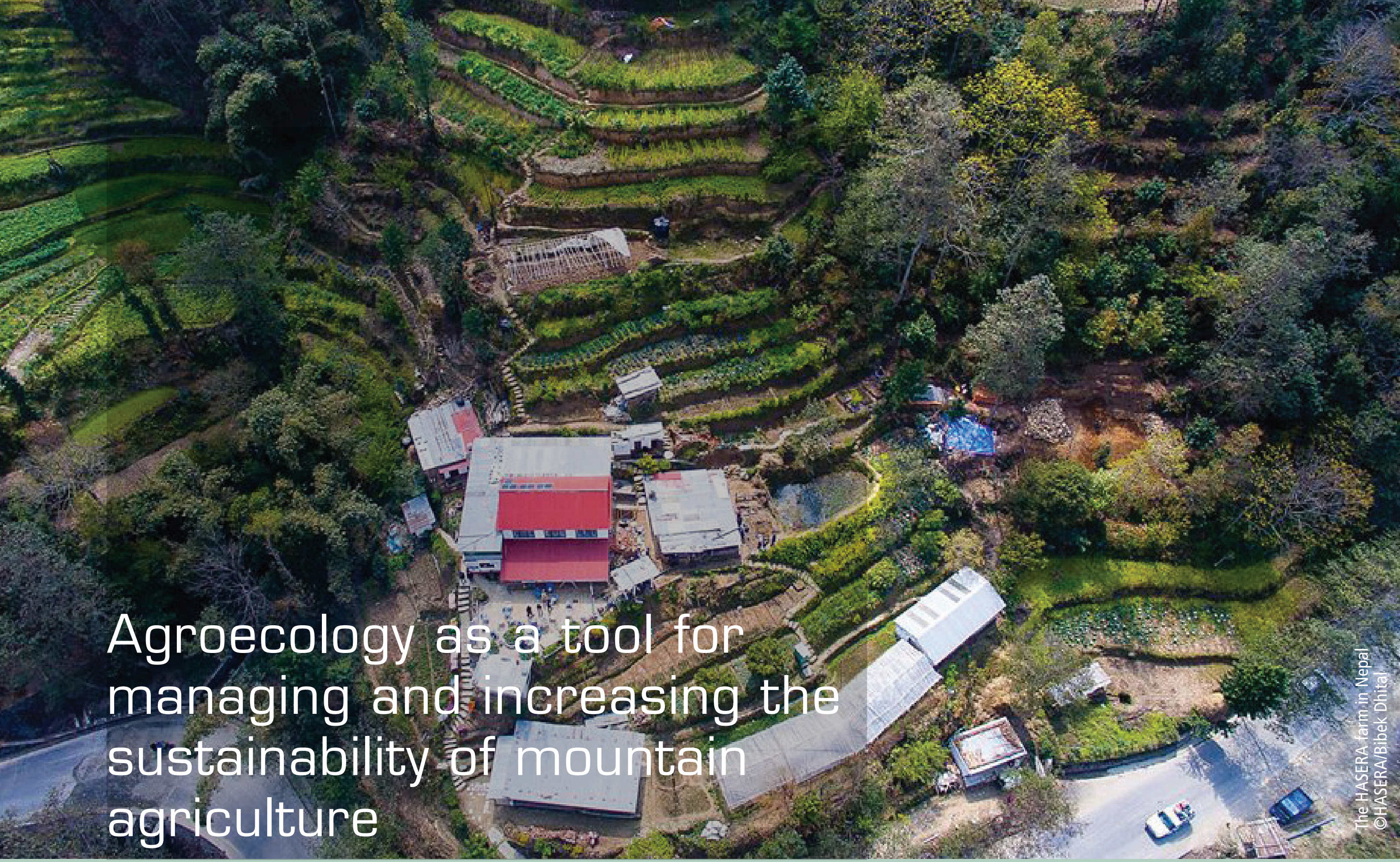
Women's empowerment

It is crucial that women play an active role since they are often the chief holders of valuable indigenous and traditional knowledge, as well as custodians of native seed diversity and resilient cropping practices, despite having the heaviest workloads and suffering malnutrition (Nepal). If women are made more aware, and their fundamental role is recognized, they can become key facilitators, involving and motivating other women and helping to improve food security and nutrition (Armenia, Plurinational State of Bolivia).

Lamon beans in Italy
©Consorzio per la Tutela del Fagiolo di Lamon

3

Safeguarding agrobiodiversity and enhancing resilience



Agroecology as a tool for managing and increasing the sustainability of mountain agriculture

The HASERA farm in Nepal
©HASERA/Bibek Dhital

Abram J. Bicksler and Emma Siliprandi

Agroecology is an integrated and dynamic approach and has been promoted as a way of contributing to transforming food systems (HLPE, 2019). FAO has developed the 10 Elements of Agroecology (see Figure 1), which can be used as a guide for policy makers, practitioners and stakeholders in planning, managing and evaluating agroecological transitions.

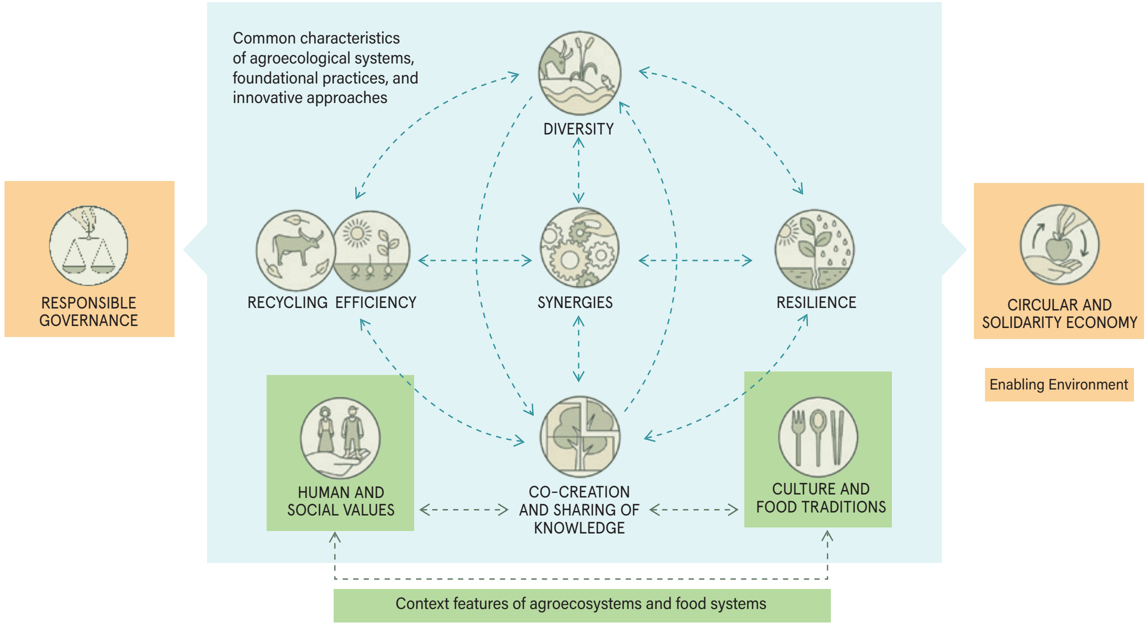

Common characteristics of agroecological systems, foundational practices, and innovative approaches
DIVERSITY
RESPONSIBLE GOVERNANCE
RECYCLING
EFFICIENCY
SYNERGIES
RESILIENCE
CIRCULAR AND SOLIDARITY ECONOMY
Enabling Environment
HUMAN AND SOCIAL VALUES
CO-CREATION AND SHARING OF KNOWLEDGE
CULTURE AND FOOD TRADITIONS
Context features of agroecosystems and food systems

Figure 1: The 10 Elements of Agroecology
Source: FAO, 2019a; adapted by MPS

The 10 elements can be used as an analytical framework to identify the challenges faced by mountain communities (including those related to the degradation of ecosystems, soil erosion, soil health, low productivity, lack of access, climate change resilience, cultural erosion, and limited technical knowledge). The framework allows actors to identify which elements are well or poorly represented in the farming system and how the sustainability (social, environmental and economic facets) of the system can be bolstered. It is important to note that the elements are interconnected and interdependent and offer many different entry points for holistic thinking about the system (Barrios *et al.*, 2020). It should also be noted that agroecology is not limited to production but encompasses the entire range of food systems across sustainability dimensions.

In common with mountain agriculture, agroecology embodies a holistic view of food and agricultural systems, emphasizing people's central role in shaping the way that systems can be transformed.

Protecting Lamon beans from viruses that threaten their production and agrobiodiversity in Italy

Tiziana Penco, Paolo Ermacora and Carlo Murer

*The Lamon bean (*Phaseolus vulgaris *L.) is subject to recurrent viral epidemics, causing severe productive losses. Viruses cannot be cured and the ecotypes currently cultivated lack genetic resistance. The FaLaRes (Resistant Lamon Bean) project aims to select plants which, under high infective pressure conditions in fields, show resistance or tolerance to viruses. This continuous selection process may lead in the medium term to the selection of tolerant or resistant ecotypes. Farmers will have healthy seeds available, derived from a process of "guided co-evolution" with pathogens, and therefore with enhanced resilience.*

The Consortium for the Protection of the Lamon Bean is a non-profit association of producers established in 1993, based in Lamon village and including 20

Lamon beans growing in Italy
©Consorzio per la Tutela del Fagiolo di Lamon

municipalities in northern Italy's Belluno Province (Veneto Region). It involves about 100 farmers, with a total cultivated area of 13 ha and a Protected Geographical Indication (PGI) production of 16 000 kg of beans per year. The PGI label, awarded to the bean in 1996, implies total traceability, a strong characterization and recognition of the product, and good economic valorization on the market.

The consortium's objectives are to:

- provide technical agronomical assistance;
- ensure the production and provision of certified quality seeds to consortium farmers;
- protect and manage the use of the Lamon beans brand, combating counterfeits;
- organize events to promote the bean, in Italy and abroad; and
- activate research and innovation projects to ensure sustainable bean production.

Recurrent epidemics of viruses have affected the Lamon PGI bean in recent years, with the entire harvest lost in 2012 due to disease. The population of Lamon beans was secured thanks to a quantity of seeds saved from the previous year. The viruses, known as Bean Common Mosaic Virus and Cucumber Mosaic Virus, are both transmitted through the seeds, to the new generation, and through aphids.

Experience shows that massive use of chemical insecticides to control aphids is not effective in preventing the spread of the virus, nor can the use of virus-free seeds control the spread of disease. With the local economy and biodiversity under serious threat, a project was needed to ensure continued and sustainable bean production for farmers.

The challenge was significant. Virus-resistant cultivars of the Lamon PGI bean do not exist. Genetic crosses between current Lamon beans and other (non-Lamon) resistant varieties would not conserve the typical historical and organoleptic characteristics of the Lamon lines. Particular traits of these traditional mountain beans are their thin skin, high digestibility and high calcium, amino acid and vitamin C content. It is critical that these characteristics are protected when selecting resistant bean plants, if the Lamon's valuable heritage is to be retained.

One promising opportunity to solve the problem lies in exploring research into induced resistances. Plants that are inherently susceptible to pathogens can become resistant after stress inductions, such as infections of pathogens. This approach, known as Systemic Induced Resistance, is a form of induced resistance that involves activating previously dormant genes to enhance resistance. This is a phenomenon that is similar to vaccinating animals. The project's goal is to select four induced lines of the Lamon bean in the field.

Researchers will conduct a selection of those plants not showing symptoms of any virus, and those that have the best productive characteristics. This selection will be assisted by an analytical verification of the causes behind the absence of symptoms, so as to understand any possible genetic influence. The seeds obtained by supposedly resistant plants will be propagated in an insect-proof greenhouse, for several cycles. The pool of induced plants will be periodically enriched with new induced plants selected in the field, year by year.

As a result, it will be possible to provide farmers with healthy, local, adapted and induced seeds for resistance/tolerance to viruses, with enhanced resilience. In this way, annual output is expected to be less dependent on epidemics of viruses.

The main activities involved include: searching for Lamon bean plants that behave as resistant or tolerant to viral plant pathogens in the field; experimental confirmation of the status of resistance/tolerance in induced plants by artificial inoculations and application of laboratory techniques in order to select induced and healthy plants; and molecular studies to investigate origin of resistance/tolerance mechanisms. Improved virus-free seeds with enhanced resilience will be supplied to growers annually, and knowledge shared through local meetings and via several publications and a dedicated website: www.fagiolodilamon.it.

After the first year of research and experimentation, the results are promising. Resistant plants have been selected from the fields of consortium farmers. The year 2019 proved to be one in which the aphid virus vectors were highly active, so this strong pressure from the pathogens enhanced the possibility of identifying resistant plants.

Seeds of these supposedly resistant plants will be verified in the next growing season, both in the field and in the greenhouse; in the greenhouse, these plants will be artificially infected with the viruses, to check their actual resistance. The resistance to viruses will be further verified through genetic analysis in university laboratories, in order to better understand the mechanism of induced plant resistance.

The HASERA farm in Nepal uses the permaculture method of farming
©HASERA/Bibek Dhital

Permaculture revives sustainable agriculture on HASERA farm, Nepal

Bibek Dhital

Agriculture is not just a question of farming. It's our daily life – it's who we are, and once we pollute the system with chemicals and bad practices, we are lost in our own creation. Today, we have the chance to be world leaders in the production of healthy food; joining hands in this movement is what permaculture is all about. In Nepal, the HASERA farm has been practising permaculture since 1993 and is an example of how one small act can have a far bigger impact.

In Nepal, pesticide contamination and haphazard agricultural modernization are relatively recent, compared with its neighbours such as India and China, as well as many developed countries. The trend, however, is shifting from diversified agriculture to monocropping, and today chemical-based farming has become a major concern for every institution involved in agriculture.

Since its creation 27 years ago, the HASERA farm, situated in Kavre, Nepal, has adapted to and promoted the permaculture method of farming. When purchased for farming, the land was a barren hill surrounded on all sides by commercial farms. Without any source of irrigation, and situated in a hilly landscape where 80 percent of the rainfall was concentrated during the three-month rainy season, farming conditions were extremely challenging. The farm's owners, who had studied agriculture – particularly organic farming and permaculture – introduced rainwater harvesting, grey water harvesting, mulching, tree planting, farm zoning and many other permaculture principles to make the best use of a few hundred litres of water harvested on a daily basis, taking care not to let a single drop go to waste.

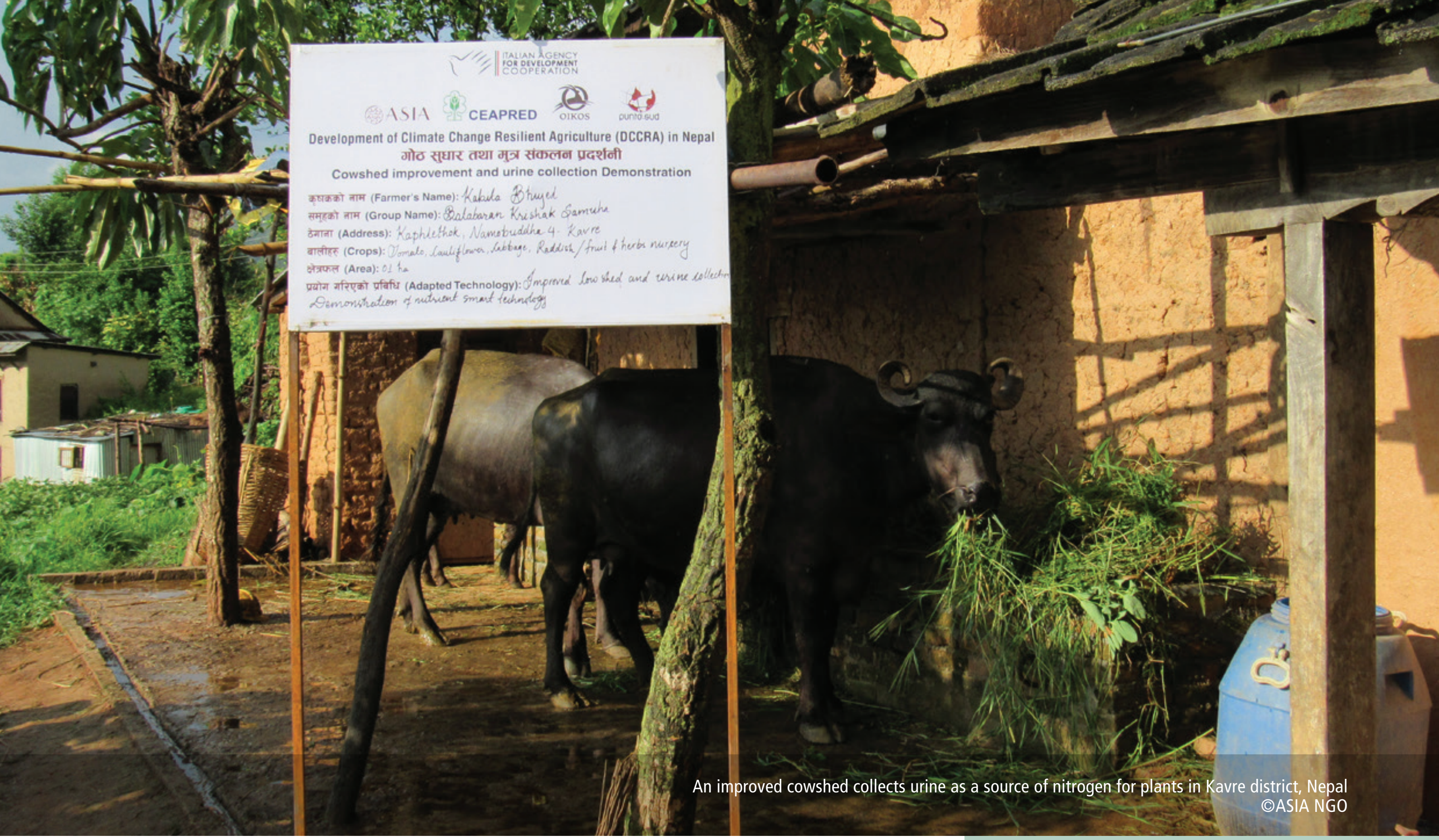
The major organic practices adopted for pest management include planting a mix of crops from at least three botanical families, using trap crops for selective insects (ants), multicolour plantations (vegetables and flowers) to attract pollinators, and insect repellents such as onion, garlic and coriander to deter insects. However, once a farm becomes mature, with plenty of perennials and well-enriched soil, the problem of insect-based pests and disease generally declines, with nature doing most of the work to keep a healthy balance.

In line with the social principles of permaculture, the farm also offers technical expertise to farmers, and most of the surrounding commercial farms no longer use chemical fertilizer as a result, opting instead for biopesticides and traps. Their output is therefore organic and is marketed through a farmers' market run by the HASERA farming family, who are currently establishing a PGS certification.

The annual edible biodiversity of the farm comprises around 92 different crops, which include different vegetables, beans and cereals, etc.; the total biodiversity that the farm supports (perennials, planted crops, flowers, forest species and weeds) is more than 500 varieties. Butterflies, spiders, mantises and other beneficial insects can be seen all around the farm. This rich biodiversity has made a major contribution to making compost, saving water in the soil, promoting microorganisms, and achieving self-sufficiency in agricultural production. The average production of vegetables is 3 kg/m^2 or 30 tonnes/ha – much higher than the national average of 10–15 tonnes/ha.

With its sloping land, the farm is a practical model for terrace farming. It also has a farm stay facility and has hosted visitors from 92 countries. Some of these people come to learn Nepali traditions and culture, try traditional Nepali cuisine, and learn about the permaculture lifestyle and farming methods. At the heart of the farm's zoned design is the house (Zone 0), almost in the centre of the farm and surrounded by a vegetable garden (Zone 1), most of which lies below the kitchen and washing area, making irrigation much simpler. Edible leftovers from the kitchen are fed to the cows, goats and chickens, while the waste goes to the compost pile, which nourishes the soil. Herbal tea from the herbal and medicinal garden, in front of the kitchen, is offered as a welcome gift to visitors. The edge of the terrace in Zones 2 and 3 is lined with hedgerows, where numerous fodder species (ipil-ipil, mulberry, *Listia* spp., *Bauhinia*, Napier grass) are planted to provide for the farm animals year-round. In winter, these fodder hedges are pruned into bushes to prevent them from shading the crops on lower terraces. The narrow terraces are planted with a range of crops, mixed and rotated during the season. In the corner runs a drainage canal, with swales (shallow channels) every 3 m, which serves for water catchment, soil erosion control and as a recharge site for water during the rainy season.

The major objective of the farm is to be as self-sufficient as possible in food production and to recycle all of the waste generated in the process, with large volumes of tomato, potato, rice and wheat cultivated. According to the principles of permaculture, the social component is also important, helping to make the system much stronger and more sustainable.


ITALIAN AGENCY
FOR DEVELOPMENT
COOPERATION
ASIA
CEAPRED
OIKOS
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Development of Climate Change Resilient Agriculture (DCCRA) in Nepal
गोठ सुधार तथा मुत्र संकलन प्रदर्शनी
Cowshed improvement and urine collection Demonstration

कृषकको नाम (Farmer's Name): Kabila Bhujel
समूहको नाम (Group Name): Balabaran Krishak Samuha
ठेगाना (Address): Kaphlethok, Namobuddha 4 Kavre
बालीहरु (Crops): Tomato, Cauliflower, Cabbage, Raddish / fruit & herbs nursery
क्षेत्रफल (Area): 01 ha
प्रयोग गरिएको प्रविधि (Adapted Technology): Improved Cow shed and urine collecti
Demonstration of nutrient smart technology

An improved cowshed collects urine as a source of nitrogen for plants in Kavre district, Nepal
©ASIA NGO

Climate change-resilient agriculture in Nepal

Alessandra Nardi

The "Development of Climate Change-Resilient Agriculture in Nepal" project strengthens the system for sustainable agricultural production with an inclusive model that favours food security while strengthening the local market. The aim is to produce more food of higher quality while using fewer natural resources and synthetic chemicals, to increase producers' incomes and set up a certified production system.

The agricultural production system in Nepal is characterized by subsistence agriculture. It has always been based on natural production techniques, used to promote the coexistence of all the elements of the ecosystem (soil, plants, animals, people). In the past, synthetic fertilizers and pesticides have been little used, but the arrival of industrial agriculture has exacerbated environmental problems. The increased use of hybrid seeds has also led to genetic pollution and to the gradual loss of local varieties. A major earthquake in 2015 reduced farmers' capabilities to produce the seeds needed for their basic food requirements.

To address this challenge, in recent years some farmers have begun to introduce agricultural systems that can increase productivity without excessively affecting water resources, through climate change-resilient mechanisms. Organic farming represents one of the most important strategies for this purpose, with significant positive economic, health and environmental impacts. This sector also has high income generation potential in peri-urban areas, is attractive to young people and can help to reduce alarming rates of youth migration to urban areas or abroad.

In 2016, Italian NGO the Association for International Solidarity in Asia and its partners the Istituto OIKOS Onlus and Fondazione punto.sud, in collaboration with local partner the Centre for Environmental and Agricultural Policy Research, Extension and Development, carried out background assessments for a project aimed at strengthening sustainable agricultural production, increasing producers' incomes, and promoting entrepreneurship, market access and domestic trade, with a particular focus on women.

From the studies, field visits, and meetings with farmers and local authorities, various problems emerged. The country's changing climate, with rainfall concentrated in short, intense bursts, takes a heavy toll on crops and increases erosion. The consequences are more intensive use of land, accelerated erosion events and a decline in production. Famers' profits are very low and the cost of land very high.

In December 2016, the project was co-financed by the Italian Agency for Development Cooperation. During implementation, numerous activities were carried out, with around 4 500 direct beneficiaries (about 50 percent women). These included participatory identification and selection of local varieties; scientific analysis of the varieties selected; establishment of cooperatives; training in seed production; construction of storage infrastructure; promotion of bioinsecticides, biopesticides and biofertilizers; training and roundtables with entrepreneurs and retailers; establishment of PGS protocols; creation of a brand to certify the quality of products; developing a marketing strategy for product promotion, improvement of market access and launching commercial relationships; improvement of animal breeding and nutrition techniques compatible with agriculture-resilient practices; and subgrant pilot projects. After two-and-a-half years of activities, some best practices have been identified:

- **Vegetable collection centres:** Farmers' groups came together to launch a common vegetable collection centre to gain greater reach through collective marketing via a single sales depot, leading to more control over vegetable quality and branding.

Low-cost plastic tunnels help vegetable farmers achieve higher yields and earnings in Sindhupalchowk district, Nepal
©ASIA NGO

- **Plastic tunnels:** These bamboo and plastic structures have helped vegetable farmers to achieve much higher yields and earnings; the low-cost technique uses locally available materials and is suited to small areas.

- **Nurseries:** In order to conserve, multiply and distribute selected local and indigenous crop varieties, four nurseries in each district have been established at various altitudes.

- **Model farms:** The project has established nine model farms where climate-smart technologies are integrated. As these farms are designed to be the focal point in the village, farmers are encouraged to learn different improved and climate-smart agricultural practices here, before replicating them in their fields.

- **Community irrigation schemes:** The project supported the community with irrigation facilities (plastic wastewater collection ponds, soil cement tanks, lift cum sprinkler irrigation and solar irrigation systems) for increased, year-round vegetable production. Botanical pesticides prepared from a variety of plant ingredients soaked and fermented in cattle urine provide an alternative to chemical pesticides.

- **Drip irrigation:** Farmers face water shortages for irrigation between the end of one monsoon and the next pre-monsoon period. This limits agricultural production and leads to much land being left fallow after the monsoon crops have been harvested. Drip irrigation is a cost-effective way of making the best use of available water.

- **Market trials:** This highly effective approach involves providing a platform for consumers, vendors, traders and market enablers, to enable direct exposure and interaction with producers.

- **Improved cowshed management:** The project supported the construction of improved cowsheds for the collection of urine as a source of nitrogen for plants.

- **Subgranting pilot project:** A subgrant component aimed to complement the project benefits. These seven pilot projects included additional activities to maximize the scalability and replicability of main project activities for communities that were not direct beneficiaries.

Thanks to the project, on our farm we have implemented all the smart agriculture techniques and our revenues have greatly increased in one and a half years of activities. Now, we have increased production and the products are qualitatively better than before. My husband didn't have to leave Nepal in search of a better job and we managed to build a new house that we called "organic house" in honour of the project.

Tara Kesi
Woman farmer
in Kavre District

Thanks to the use of biofertilizers, biopesticides and vermicompost, which I learned to do during the project, my potatoes are bigger and I can sell them at the market for 25 Nepalese rupees (I used to sell them for 19 Nepalese rupees). Today the production is so much greater that the potatoes that I do not sell to the market I use as seeds.

Dhurba Regmi
Woman farmer
in Sindhuli District

A model farm in Kavre district, Nepal
©ASIA NGO

Reviving and strengthening indigenous food systems in the Philippines

Florence Daguitan

Women members of the Pidlisan tribe have played a leading role in reviving home gardens to grow a diverse range of food crops, herbs and fruits and have engaged in agroforestry, both at household level and on their communal farm. Through collective action, the women set up a cooperative to produce and sell organic products.

In the 1990s, many households in the Pidlisan tribe adopted green revolution technologies, such as planting high-yielding rice varieties, engaging in commercial vegetable production and introducing agrochemicals. Children moved out of their villages to pursue higher education, leading to a reduction in labour for the farm and weakening cultural practices of seed selection, soil fertility maintenance, field sanitation and collective work to maintain communal irrigation systems. The result was a slow but steady decline in land productivity. Meanwhile, growing numbers of the tribe moved into the mining and tourism industry, driven by the need to earn incomes. As a result, more food had to be supplied from outside the community.

In June 2011, the Indigenous Peoples' International Centre for Policy Research and Education (TEBTEBBA) responded to a request to assist the Pidlisan community. After assessing the situation of the ancestral domain and its people, the association worked together with the tribe to increase awareness through participatory

Network of women implementing innovations in ricelands, Philippines
©Pidlisan Tribe Organization

Women of the Pidlisan tribe planting trees
©Pidlisan tribe of Sagada

action research and education, enhancing the community's capacity for livelihood development, promoting indigenous people's education and increasing their capacity for resource mobilization to support their self-determined development plans.

Pidlisan territory is composed of the four barangays (administrative divisions) of Aguid, Bangaan, Pide and Fidelisan in the northern part of Sagada, Mountain Province, the Philippines, with a population of 2 408 in 2015.

The indigenous peoples of Pidlisan developed their territory into one whole agroecological system for their food needs. There are three types of farm: the *um-a* or unirrigated farms, with agroforestry within or near the settlement areas; the *uma* or rotational agricultural areas in the forestlands; and the *payew* or irrigated rice lands. The participatory research conducted revived indigenous knowledge systems and traditional farming practices, such as:

- seed storage and natural breed improvement techniques;
- seeds shared and exchanged within and with neighbouring villages, planting various crops and integrating short-term and perennial crops and livestock-keeping;
- adherence to an agroecological calendar based on climate and weather; and
- integrating moon phases for favourable crop performance and maintaining the integrity and balance of different ecosystems within the territory.

In the Pilisan areas of about 4 000 ha, timberland, grassland and farmlands (payew, um-a and, in a lesser proportion, orchards) are the main land uses. Small-scale mining and residential areas (including sacred sites) are also present in lower proportions. The watershed area occupies 74 percent of the total Pidilisan territory.

Elder people recalled that “there was a time when production inputs were mainly dependent on the internal resources of their communities.” Natural vegetation and post-harvest plant residue were now turned over in the soil to feed the next cycle of crops. Producers began making their own tools, using their knowledge and acquiring more from other areas.

A major innovation involved combining traditional knowledge with modern science to produce organic farm inputs such as biofertilizers (foliar fertilizers, fermented plants and fruit juices) and harnessing indigenous microorganisms to restore soil fertility.

In order to sustain the production of organic farm inputs, TEBTEBBA supported the purchase of a shredder and the establishment of a centre for the production of organic fertilizers. The effectiveness of these farm inputs was tested by members of the Pidlisan Tribe Organization, mainly women, with a significant increase in rice yields recorded in the experimental plots, from 4.2 tonnes/ha to 7.5 tonnes/ha. The revival of home gardens in more than 300 households has enabled women to serve safe and nutritious food for their families and to market the surplus, generating an income. Through collective planning and action, in Guesang in 2017, women set up a cooperative to produce organically grown banana chips, with a knock-on effect for banana producers in the area, who now have a ready market for their produce.

Another source of income is the production of *muscovado* unrefined sugar, with processing done in a communally-owned sugar cane crusher. As demand for organic farm inputs has grown, the women have become keen to diversify their income sources and now plan to produce organic fertilizer for commercial purposes.

Climate-smart dairy production in the Swiss mountains

Alexandra Rieder, Jan Grenz, Andreas Stämpfli, Beat Reidy, Tamara Köke and Sebastian Ineichen

"Climate-smart Dairy Farming," a public-private initiative, has achieved a reduction of greenhouse gas (GHG) emissions per kilogramme of milk through an innovative participatory bottom-up approach and a goal-oriented payment system. The project shows high potential for upscaling, leading to a potentially high impact on GHG reduction in Swiss agriculture.

Switzerland's temperate climate, alpine meadows and small farm structures provide good conditions for livestock production on family farms. Dairy cows, many of which spend the summer or even the whole year at altitudes of more than 1 000 m, are a mainstay of Swiss mountain farmers. However, these producers are economically challenged, with the lowest revenues in Swiss agriculture, which are already well below those of the non-agricultural population. Compounding the difficulties, climate change threatens biodiversity and the entire sustainability of the fragile mountain ecosystems.

The Swiss Confederation has pledged to cut its total GHG emissions from agriculture by one-third by 2050. Agriculture accounted for 12.9 percent of Switzerland's total GHG emissions in 2017, with more than one-third caused by dairy cattle, mainly in the form of methane from enteric fermentation. Meanwhile, Nestlé, a major Swiss milk buyer, aims to achieve zero net GHG emissions by 2050. These combined ambitions led to the launch of the Climate-smart Dairy Farming project in 2017.

The initiative is a public-private partnership between a producer organization, Aaremilch, milk processor Nestlé, and the Swiss Federal Office of Agriculture. Scientific support is provided by the Bern University of Applied Sciences. Owned by farmers, Aaremilch trades around 230 million kg of milk a year, 70 percent of it from hill and mountain areas, mostly in the canton of Bern. The initiative aimed to reduce GHG emissions in carbon dioxide equivalent (CO_2-eq) per kg of milk by 10 percent by the end of 2020, from baseline values for 2014–2016. The GHG reduction was to be achieved in an agroecological way, without damaging other areas of the environment. Created through a participatory, bottom-up approach, involving dairy producers from the outset, the project included goal-oriented premium payments per kg of milk from Nestlé.

Eligible GHG reduction measures are: (1) increasing lactations per cow, thus reducing the share of non-productive animals in the herd; (2) increasing lifetime performance (kg of milk per life day); (3) feeding manure and slurry to biogas fermenters; (4) increasing coupled meat production through insemination with double-use breeds and sperm sexing. Two further measures are under research, namely (5) increasing feed efficiency; and (6) using methane-inhibitory feed additives, such as linseed.

Beyond the climate-related goals, a holistic approach was adopted to prevent side effects, such as aggravated food-feed competition. The programme also aimed to increase farmer income, or at least not cause additional cost. Given the difficult economic situation of many Swiss mountain farmers, these criteria are crucial when it comes to upscaling the initiative and assuring its long-term sustainability.

Project impact is monitored annually based on individual farm data and a computer-based tool that calculates GHG emissions and land demand from dairy production, on- and off-farm feed production, on-farm energy use and manure handling. Dry matter, protein and energy balances for lactating cows and the whole herd are calculated by the same tool, to optimize feeding practice.

Reducing GHG emissions per kg of milk on these farms is a challenge, given their low calculated baseline emission of 0.93 kg CO_2-eq/kg milk, 0.64 kg CO_2-eq/kg of which are caused by enteric fermentation and manure management "direct GHG emissions." These low values are a consequence of the high share of digestible roughage from meadows and pastures fed to the cows. Nevertheless, the 46 pilot farms, which deliver 7.5 million kg/year of milk to Aaremilch, have managed to reduce emissions by more than the amount necessary to be on track for a 10-percent reduction by the end of 2020. The project has a goal-oriented payment system for farmers, whereby they receive a fixed monetary incentive to participate in the research part and obtain a price premium for the effective GHG reductions achieved, based on individual goals. This innovative payment method has proved effective in motivating farmers to implement the climate-smart practices.

Simmental cows participating in Nestlé SA and Aaremilch's climate-smart dairy farming programme
©Nestlé Suisse SA/Remo Nägeli

Starting in 2019, the volume of climate-smart milk has been expanded to 22 million kg per year, produced on 147 farms to test the scalability of the project. If the adopted practices were upscaled to the whole Swiss dairy herd, much of the countrywide agricultural GHG reduction goals could be achieved within a couple of years. Capacity development and face-to-face dialogue among farmers, industry officials and scientists have continued throughout the project's duration and helped to build mutual trust and understanding. The farmers have acquired and implemented knowledge about methane reduction measures at farm level, which has contributed to an inclusive agroecological transition process. Calculating robust GHG balances based on a limited set of input data (for efficiency reasons) has proved challenging, but efforts to refine the herd-level GHG calculator continue to stimulate knowledge exchange among science, industry and farmers.

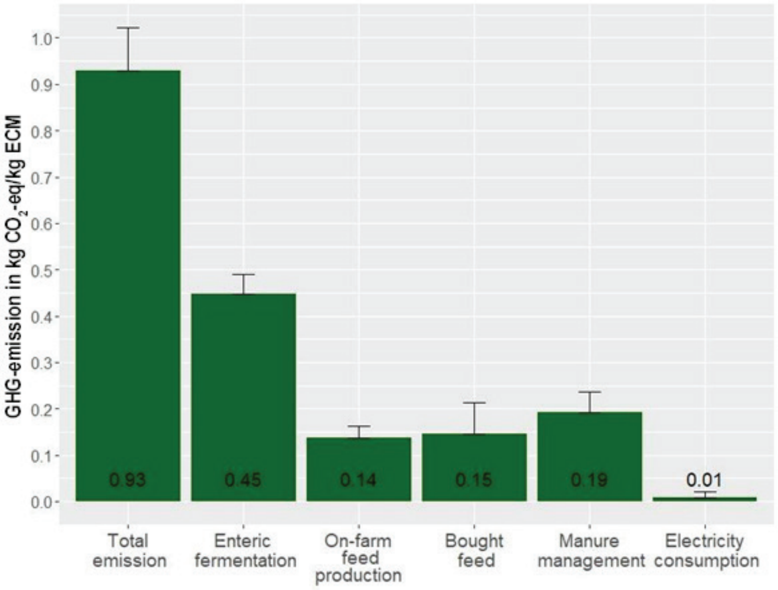
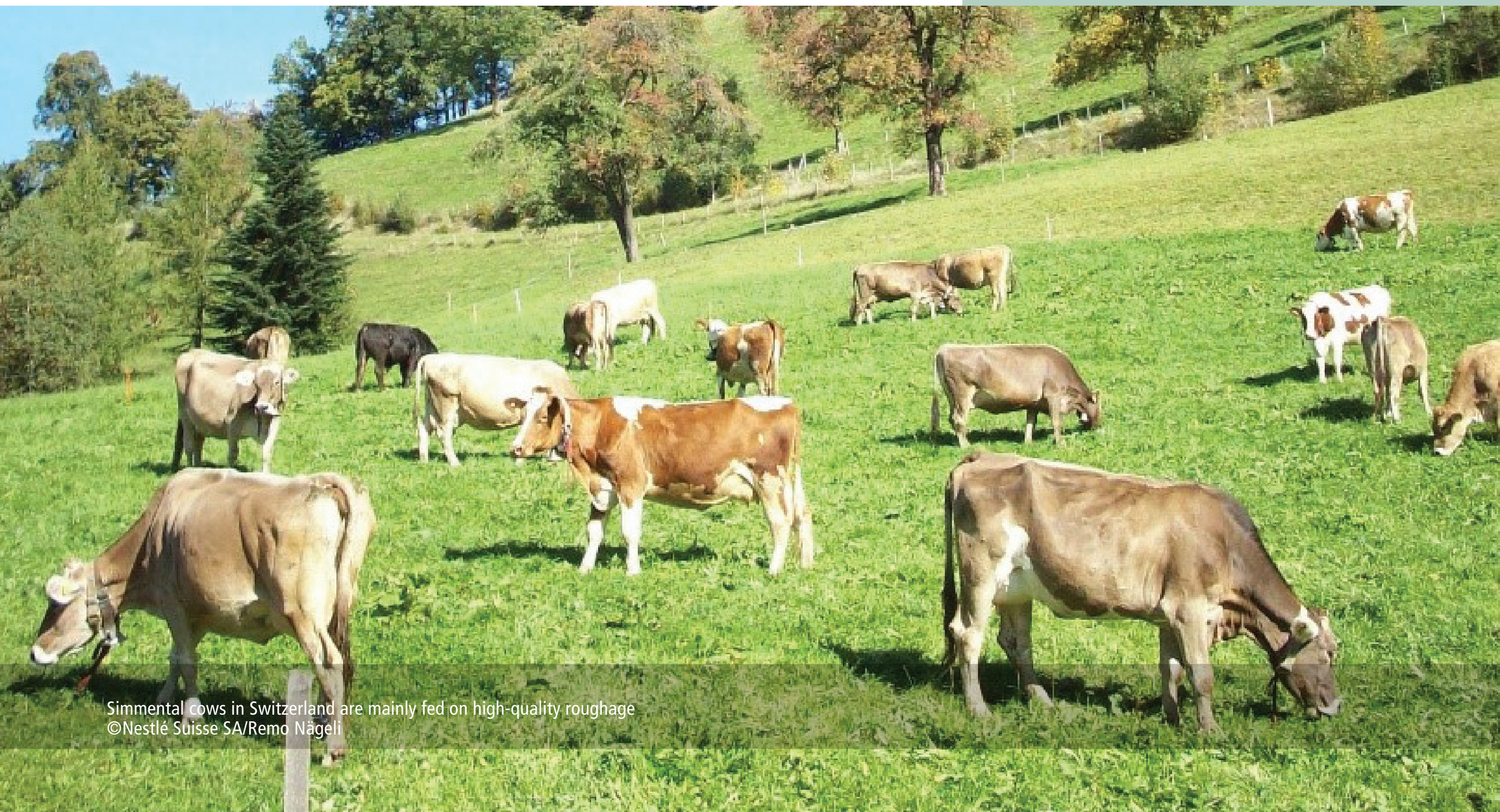


Figure 2: Average greenhouse gas emissions per litre of milk from the 46 pilot dairy farms participating in the Climate-smart Dairy Farming project, baseline values for 2014–2016, are calculated with the KLIR 1.8 tool of HAFL. Standard deviation is shown on the top of each bar.

Source: Case study authors' own elaboration, 2020.



Simmental cows in Switzerland are mainly fed on high-quality roughage
©Nestlé Suisse SA/Remo Nägeli

Biogas cookers promote equality in gender roles in Mt. Livingstone, United Republic of Tanzania
©GEF Small Grants Programme Tanzania/Stella Zaarh

Organic farming breathes new life into Mt. Livingstone, United Republic of Tanzania

Nehemiah Murusuri and Wilbert Mtafya

Synergies between biogas technology, organic farming and conservation of mountain ecosystems are demonstrated through wide adoption of biogas plants around Mt. Livingstone in the United Republic of Tanzania. Slurry, a by-product of the biogas production process, is an effective organic fertilizer for crops. Studies show that each biogas plant saves an annual 0.12 ha of woodland, which would have been felled for fuelwood.

The Renewable Energy (Biogas) Construction Programme for Rungwe District was developed in 2016 in partnership with Tanzanian NGO Hifadhi ya Mazingira na Utalii Rungwe, in consultation with the African Wildlife Foundation and the Isangati Agricultural Development Organization. It is based on a renewable energy technology project, Environmental Conservation and Enhancement at Kyimo, Ikuti and Idweli Villages, which was supported by the Global Environment Facility (GEF) Small Grants Programme in 2012 and which constructed six biogas plants for demonstration.

The project involved constructing 160 biogas plants in six villages adjacent to the mountains. The communities identified as project beneficiaries provided labour, such as excavation of trenches for biodigesters and pipelines. The NGO technicians' role was to set up and connect the digester, and to test, commission and train users in plant operations and maintenance.

Farming practices in the area are poor and characterized by very low crop productivity. The project tested the effectiveness of adopting biogas technology to promote organic farming, improve community livelihoods and conserve the

Mt. Livingstone ecosystem. Main activities included: selecting 160 pilot farmers and constructing a biogas plant for each of them; training demo farmers in operations and maintenance of biogas plants; training demo farmers in conservation of eco-friendly, high-yielding farming techniques and the use of bioslurry and natural pesticides for organic farming; and biodiversity conservation for ecosystem health and ecological services.

The main outcomes are:

- the use of bioslurry and dry manure increasing and slowly replacing industrial fertilizers;
- crop productivity for demo farmers increasing up to fivefold and other community members switching to sustainable farming methods;
- The use of 160 biogas plants estimated having saved 38.4 ha of woodland in the past two years, contributing to the conservation of Mt. Livingstone where most fuelwood is collected;
- biogas cookers having promoted equality in gender roles (since cooking by biogas is simple and clean, even men can now cook for the family); and
- 160 pilot households (930 individuals) in six villages benefiting from using biogas plants for cooking, lighting their homes and using bioslurry for organic farming. Indirect beneficiaries include about 7 200 people who learned about biogas technology through demonstration and observation methods.

The renewable energy technology project that underpinned this case study was supported by the GEF Small Grants Programme, which in 2012 gave USD 23 607 to assist young people around Mt. Livingstone to plant trees in degraded areas of the mountain. Selected local people were also sensitized to establish fuelwood farms, in order to relieve pressure on trees growing on the mountain slopes. Altogether, 50 000 trees were planted. In addition, the NGO supported the establishment of six biogas demonstration plants, to show mountain communities how to use biogas and reduce the use of fuelwood for cooking and heating.

A key challenge identified during the project was that many farmers are keen to adopt biogas technology and organic farming but lack the capital and/or credit facilities to do so.

The use of biogas plants saves woodlands and contributes to the conservation of Mt. Livingstone
©GEF Small Grants Programme Tanzania/Stella Zaarh

The Huerto Orgánico Lak´a Uta is the first urban community food garden in Bolivia
©Fundación Alternativas

4

A circular and solidarity economy that adds value to products

The circular economy in mountain areas

Woman volunteers in the Huerto Orgánico Lak´a Uta in Bolivia
©Fundación Alternativas

The circular economy approach is one of FAO's 10 Elements of Agroecology and aims to better connect producers and consumers and to create fair and short distribution networks. It is based on the "sharing, leasing, reuse, repair, refurbishment and recycling" of products and materials in an ideally closed loop (Whitaker, 2017). The potential of the circular economy's adoption and development is particularly strong in mountain areas, due to its linkages to exceptional primary resources such as forests, water, minerals and agrogenetic resources.

Furthermore, the circular economy is particularly relevant to mountain areas, where the marginality and fragility of systems push the communities living there to cope by implementing optimized energy systems, processing fluxes and managing natural resources.

Keeping products and materials within the economy of mountain territories is crucial to reduce waste and increase the value of resources and ecosystem services such as clean water, carbon sequestration, landscapes and agritourism. Employment opportunities and economic growth can increase if a circular economy approach is envisioned.

New business models are necessary, such as service- and function-based models, collaborative production and consumption, sharing materials and resources, and considering waste as part of them. Globally, and specifically in mountain areas, it is essential that supply and demand are balanced and that the exchange of materials, products and services across the supply chain is planned in a sustainable manner. Collaboration and participation of actors, with a shared vision of sustainable future development, is a condition *sine qua non* for scaling up the circular economy. Participatory Guarantee Systems can be considered as an example: sharing time, assistance and responsibilities towards the organic certification of products is in line with a circular economy approach.

Participatory Guarantee Systems: a tool for sustainable mountain development

Patricia Flores

The high cost of third-party certification for organic production and its disconnection with the values of many agroecological farmers' organizations, combined with the inexistence of regulations on organic agriculture and production in many countries, led to a demand for the social construction of new markets for organic products, where farmers and consumers were at the core of these initiatives. Participatory Guarantee Systems are low-cost quality assurance systems, suitable for smallholder farmers. This participatory approach presents an alternative to third-party certification for organic agriculture. Experiences from all over the world have found that the PGS can be an important platform for the development of social processes among producers and between producers and consumers, and has the potential to make a significant contribution to reducing food insecurity and to improved nutrition among farmers in rural areas.[2]

The collective impetus of the PGS allows other positive outputs, such as:

- Knowledge management and agroecological solutions. Participatory Guarantee System participants can play the role of rural service providers of technical assistance, such as through farmer-to-farmer knowledge exchange. Members of a PGS initiative may have the capacity to collectively pay for the technical assistance that they need. This cost is mostly included in the system's overall budget. Initiatives of a PGS contribute to traditional knowledge maintenance and dissemination and empower farmers to make use of locally available inputs and breeds, thereby contributing to improved natural resource management in communities.

- Collective marketing to supply short chains in rural, peri-urban and urban markets. Based on evidence from the Nutrition in Mountain Agroecosystems project, markets in semi-rural and urban mountain areas are often highly attractive, valorizing the quality of native, highly nutritious and diverse food. The PGS gives farmers access to specific markets, reduces costs related to market organization, and helps to reach consumers on a larger scale.

- Social bonds and trust being strengthened, leading to strong social organizations. Many PGS initiatives have empowered stakeholders engaged in policy-making processes, advocacy and increased outreach to demand more specific needs that have been identified collectively. Implemented by stakeholders involved in organic production, PGS initiatives strengthen social structures, thereby helping to address the specific challenges of agro-ecosystems in mountainous areas.

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[2] More information available at: https://www.ifoam.bio/our-work/how/facilitating-organic/nutrition-mountain-agro

Families grow fruits and vegetables in an urban community food garden
©Fundación Alternativas

- Increased farm income. The social construction of markets linked to a PGS initiative leads to short value chains, reducing intermediaries, while prices can be collectively settled to make them affordable to producers and consumers.

- Genetic resource conservation. Consumers demand a diverse basket, with as many different food groups as possible, so as to cover nutritional needs and maintain a healthy diet. In a PGS, the close connection with consumer demand for diversified production offers an opportunity to introduce the necessary changes in crop arrangements and in farmers' decisions on what and how much to produce. Traditional seeds, particularly from native strains, varieties and ecotypes, are the basis for diversified production. For this reason, community seed banks are developed, and traditional seeds are conserved and exchanged.

- Small-scale savings systems are developed in a PGS to cover common expenses for the system and related PGS markets. This may subsequently enable producers to access financial markets, in order to increase the size of their operations or add value to their products.

- Certification cost savings. In monetary terms, the PGS significantly reduces the cost of organic certification compared with third-party certification. In some cases, third-party certification can be almost five times more expensive than PGS on an annual basis.

- Enhanced food security and improved nutrition. Smallholder members of a PGS initiative are more likely to achieve food security and improved nutrition, with diversified production and consumption. Healthier diets are achieved by accessing better markets to sell products, improving productivity of cash and subsistence crops, and increasing education in better decision-making about how to complement household food baskets.

Urban agroecology at 3 900 metres above sea level in La Paz, Plurinational State of Bolivia

María Teresa Nogales and Johanna Jacobi

The Huerto Orgánico Lak´a Uta is the first urban community food garden in Bolivia (Plurinational State of). Located at about 3 900 m, the garden houses 40 plots and is dedicated to organic food production. Set in the highland city of La Paz, the garden promotes urban agriculture, fosters community values and outdoor recreation and encourages neighbours to adopt healthy diets.

Although food security and nutrition are fundamental pillars of social well-being in the Plurinational State of Bolivia, these tend to be left out of urban development and planning processes. Failure to address these topics exacerbates existing weaknesses in local food systems, which inevitably affects citizens, especially the poor, and their capacity to access affordable, healthy food. Today, more than 60 percent of Bolivians are malnourished, while 42.7 percent are overweight or obese.

Local non-profit organization Fundación Alternativas garnered support to launch the Plurinational State of Bolivia´s first community food garden. The Huerto Orgánico Lak´a Uta, founded in 2013, is located on one of the many steep slopes of La Paz. The garden has been developed in a once densely populated neighbourhood that was buried in a landslide in the 1990s. Abandoned for close to 20 years, the park was frequented by alcoholics and was notorious for violent

LOS AMIGOS DEL HUERTO
LAS ARAÑAS
LOS PÁJAROS
LAS MARIQUITAS
LAS AVISPAS
LAS ABEJAS
LAS MARIPOSAS
LAS CRISOPAS
LAS MANTIS RELIGIOSAS
LOS SAPOS
LAS LOMBRICES
LOS ENEMIGOS DEL HUERTO
LOS CHINCHES
LAS MOSCAS BLANCAS
LAS HORMIGAS
LOS ÁCAROS
LOS HONGOS
LAS TIJERETAS
LAS ORUGAS
LAS BABOSAS
LAS COCHINILLAS

A sign welcomes visitors and volunteers to the Huerto Orgánico Lak´a Uta in La Paz
©Johanna Jacobi

incidents. Today, it is home to a community garden made up of 40 plots, where families grow more than 30 different varieties of fruits and vegetables. Fundación Alternativas provides technical support in ecological urban farming methods, lends tools, keeps a small seed bank and provides materials such as wooden pallets, which nearby enterprises donate to support the garden. To date, more than 7 000 people have visited and/or volunteered in the garden, many of whom have also begun to grow food at home.

The participating families have become active change agents in their communities, where they practise and promote urban agriculture as an instrument to improve food security. In 2018, having visited the garden on several occasions, the local government of La Paz introduced Municipal Autonomous Law 321 for the Promotion of Urban Food Gardens in the Municipality of La Paz. The first of its kind, this law enshrines an obligation to make municipal land available to the public, so that people can set up food gardens in their communities.

The Huerto Orgánico Lak´a Uta is open to the public and offers visitors and community members a place for healthy recreation, as well as interaction and reconnection with Pachamama (Mother Earth). The garden has adopted low-cost production models based on recycled material and focuses on ensuring that each family can produce food to complement its regular diet, together with the preservation of community values and customs. To this end, citizens have readopted *trueque* (the ancient tradition of bartering). In tandem, and in an effort to bolster community development, Fundación Alternativas organizes different activities based on ancestral Andean traditions of reciprocity, such as community potlucks (*apthapis saludables*) and collaborative workdays (*ainis*), and provides an array of workshops on food security and agroecological food production. These activities ensure that people come together to work collaboratively, share meals as a community and continuously engage in learning experiences.

In the garden, 40 families produce traditional foodstuffs (such as potatoes, oca, broad beans and maize), as well as herbs and fruits (such as tumbo and golden berries). In recent years, volunteers have shared novelty seeds and some families have begun experimenting with chard, kale and artichokes, with good results. Given the small size of plots (16–20 sq m), the harvests are primarily destined for household consumption, though when yields are abundant, families barter their produce to diversify their diets.

The community garden has set an important precedent for transforming underutilized space into green and productive areas that foster the resurgence of a sense of community. Here, people of all ages work together, learn from and share with each other, and enjoy the outdoors. They also make a conscientious effort to ensure that their diets are healthier, sustainable and adequate. Yearly evaluations conducted by Fundación Alternativas track members´ perceptions regarding the importance of the garden. Interviews conducted in 2018 with the families revealed that: for 100 percent their primary motivation is the opportunity to grow their own food; 64 percent enjoy the peace and quiet that the garden gives them; 54 percent enjoy the opportunity to spend time in nature; while 51 percent highlight that they enjoy the opportunity to engage socially with other members.

Over the years, the garden has turned into an educational platform where students learn how to grow food in an urban setting. Children and youth visit the garden to learn different growing techniques, as well as how to make organic fertilizers, grow food in small spaces and conduct pest control organically. Many go on to start small-scale food gardens in their schools, along with teachers and parents. Since 2017, Fundación Alternativas has conducted workshops for more than 300 public school teachers and community educators. With the active participation of more than 400 teachers, the organization is developing classroom material to ensure that students from kindergarten to twelfth grade receive appropriate instruction on nutrition, food security and farming.

In the course of five years, the Huerto Orgánico Lak´a Uta has become a well-known local initiative that has helped citizens to appreciate the value of urban agriculture and its ability to serve the environment, and to ensure that people can easily access fresh, healthy food. The hope is that the adoption of the municipal law on urban gardens will ensure that in the near future, many more new food gardens will spring up across the mountainous landscape of La Paz.

Women farmers celebrating their harvest in the Huerto Orgánico Lak´a Uta, La Paz
©Fundación Alternativas

NIRVANA FARMS
(Certified Organic Farms)
Deals in : Organic Vegetables, Pulses, Wheat & Rice
Home Delivery Available

PGS farmers selling fresh produce at an event in Delhi
©Gram Disha Trust – India/Ashish Gupta

Himalayan smallholders' Participatory Guarantee Systems – Small and beautiful, India

Ashish Gupta

In India's Himalayan mountains, smallholders have poor market access and low bargaining power due to lack of collective arrangements. Now, PGS are helping to form such groups, based on agroecology. Organic agriculture in the Himalayas is currently reported to be about 1.7 million ha, and the state of Himachal Pradesh contributes 10 percent. Slowly, the sustainable agriculture movement is moving up from grassroots smallholder farmers to the level of the state and the nation.

In the past, most Himalayan mountain farmers were connected to conventional markets, where they had little say in the price of their produce. In addition, long distances to market and lack of consumer confidence posed challenges to the authenticity of products, in the case of organic farmers. To break this cycle, in 2015 the Gram Disha SHG farmers group in Baag Village, Mandi District, Himachal Pradesh, decided to join the PGS certification system, with the support of the Indian PGS Regional Council – Organic Way of Life.

Primary data collection of farmers' agricultural produce and cultivation practices was the first step on the pathway to establishing a PGS. This went hand in hand with training provided to farmers, to help them switch to organic practices using various *in situ* composting and crop protection practices and, where needed, *ex situ* access to products for crop protection and soil nutrition management, though the focus was on input cost reduction.

Since 2015, the farmers have gradually reduced or eliminated the use of agrochemicals, and been assisted in selling to consumers through transparent intermediaries. These, such as Jaivik Haat (a natural and organic retail shop in Delhi) and the Delhi Organic Farmers' Market, ensure connectivity between producers and consumers. In August 2019, farmers pooled their resources to open the state of Himachal Pradesh's first farmer-run organic shop selling fresh produce, in response to growing demand for organic products from urban, peri-urban and rural areas. Other farmers' groups have now approached this PGS group to assist them in creating similar models of production, supply chains and marketing in their areas. The PGS process has helped to raise confidence among consumers, although challenges remain in ensuring a constant and reliable supply of quality produce year-round and in creating a network with other farmers within the district and state.

The farmers' group receives no support from any government subsidy or scheme, and all the innovative market linkage mechanisms are the result of their members' own efforts and resources. However, through transparency along the value chain and a direct link between producers and consumers, farmers are now receiving a fair price for their products. The close contact teaches consumers about the true cost of products, prompting them to spend more money on them, not only for their own health, but also to benefit the farmers.

Challenges and mitigation measures include:

- Lack of institutional support offered to farmers for poverty alleviation and market access. To fill this gap, farmers are collectivizing, pooling their resources – both human and monetary – to create pathways for institution-building and market access, in the hope that this may result in support for expansion in future.

- Lack of institutional credit for organic farmers to mitigate any losses during the conversion period. Pursuing their own initiatives, the farmers are optimistic that their efforts will be recognized by local rural banks, and institutional credit provided as a result, especially with subvention support.

- Women farmers' direct participation in creating a market-linked PGS is currently minimal, leading to gender disparity in terms of market access. To mitigate this problem, attempts are being made to form women-led farmers' groups.

Greater outreach is currently underway in neighbouring villages, with a view to creating other collectives and assisting them in developing market access using a PGS. With increasing market access, both local and distant, it is hoped that larger numbers of farmers can participate and form scaled-up collectives. The goal is that within a two-year time frame, it will be possible to launch a producer company based on at least 100 smallholder families.

Himachal Pradesh is one of the ten Himalayan states in India. The country's state and central governments are now working vigorously to implement institutional agroecology and digital infrastructure for organic farmers. Since 2015, schemes such as Mission Organic Value Chain Development for North-Eastern Region and Paramparagat Krishi Vikas Yojana (PKVY) have been rolled out. In 2016, Sikkim set out to become the first fully organic state in India and was selected for the prestigious One World Award in 2018. As part of the PKVY rollout, the Government of India has launched PGS, and under the PGS-India system, the Himalayan states have seen an increase in land banks. In addition, market access and the direct sale of produce by smallholders to markets have risen. Across India's Himalayan states, organic agriculture is gaining a foothold. As of 2018, Himachal Pradesh had a total of 175 306 ha under organic agriculture through PGS and the third-party certification system.

> *Farming as a profession is uniquely distinct from others. Access to the services of various professions is required with less frequency, for example, those of a doctor or lawyer, whereas the services of farmers are required for every meal we have, every day of our lives.*
>
> **Mountain farmer**
> from India's Himalayan mountains

Surplus vegetables from the farms being sold at Delhi Organic Farmers' Market
©Gram Disha Trust - India/Ashish Gupta

Native crops and wild edibles boost food security in India

Shalini Dhyani and Deepak Dhyani

In India's Western Himalaya, croplands are mainly rainfed (more than 70 percent), small (less than 0.2 ha), have low external inputs and are supported by forest and livestock. Climate-resilient indigenous crops and wild edibles support subsistence food habits. Diversified native crops of Garhwal in the state of Uttarakhand hold good prospects for building future food security, with no food miles attached. Local communities are helping in the conservation of wild edibles through domestication and bioprospecting.

The Indian Himalayan Region is a natural biodiversity hotspot, with rich agrobiodiversity and cultural diversity. Indigenous and local communities have been practising low external input agriculture using a variety of cereals, millets, legumes and oilseeds. However, in the past few decades migration has driven a shift from traditional crops and cropping practices to cash crops.

Village in Indian Himalayan Region
©Shalini Dhyan

To counteract this trend, activities implemented under the "Strengthening fodder resources and developing a pilot model for reducing drudgery of rural women in Kedarnath Valley, Uttarakhand" and the "Conserving lesser known wild edible biodiversity and indigenous traditional knowledge of locals in North Western Himalayas, India" projects have involved developing a community seed bank for the domestication of underutilized wild edible species, with the aim of increasing nutritional security. The projects have also established a livelihood resource centre to promote value addition for indigenous crops and wild edibles, and a fodder bank model to support livestock fodder requirements. All three initiatives were developed in collaboration with the village *Panchayats* (local village governing bodies) of Maikhanda, Tolma and Suraithota villages. Financial support has been provided by the Department of Science and Technology, Government of India, the Rufford Small Grants Programme UK, the GB Pant National Institute for Himalayan Environment and Sustainable Development, Srinagar Garhwal and NGO the Society for Conserving Planet and Life.

The projects were carried out in Uttarakhand in the Western Indian Himalayas from 2009 to 2019. As well as setting up a livelihood resource centre, activities involved establishing a community plant nursery and a wasteland rejuvenation model in Maikhanda village, Rudraprayag district, and a community seed bank of lesser known underutilized wild edibles in Suraithota village, Chamoli district.

The Western Himalaya is a storehouse of legume and rice varieties. More than 200 varieties of indigenous rice and 230 of Rajma (kidney beans) are grown here, as well as many traditional and indigenous legume varieties. However, significant loss of indigenous crops and cropping practices has been observed due to increased market demands for cash crops. Innovative approaches to develop support systems for forest- and livestock-dependent organic agricultural practices have helped to transform life for upland communities in Uttarakhand. In the process, a number of native crops have been used to develop value-added products. These include six main grain crops – finger millet (*Eleusine coracana*), kodo millet (*Paspalum scrobiculatum*), little millet (*Panicum sumatrense*), foxtail millet (*Setaria italica*), proso millet (*Panicum milliaceum*) and Indian barnyard millet (*Echinochloa frumentacea*) – and several wild edibles, such as tree rhododendron (*Rhododendron arboreum*), vegetable fern (*Diplazium esculentum*), box myrtle (*Myrica esculenta*), Indian barberry (*Berberis aristata*), *Viburnum mullaha*, *Neolitsea pallens* and cherry prinsepia (*Prinsepia utilis*). More than 186 farmers, including a number of women and youth, have been trained in developing a community-based wild edible seed bank and further domesticating local species through seed germination techniques.

The key challenges identified were that:

- convincing the community of the prospects and economic benefits was difficult, albeit critical; and
- replicating even successful models, such as the fodder bank, community seed bank and livelihood resource centre, requires support from policy makers and practitioners.

Value-added products are getting a better market and we are able to fetch 2 000–5 000 Indian rupees (USD 25–70) per month per household during the pilgrimage season, when a lot of tourists visit our area during summer. This has brought economic and nutritional benefits.

Bindeshwar Semwal
Shersi village

Future activities planned include monitoring the food bank model and the trial domestication of wild edibles in farmers' fields to develop agri-horticulture models by the community seed bank. In addition, the livelihood resource centre will help to train more women in value addition of wild edibles and organic crops.

Our traditional seeds and cropping patterns are threatened as well as the traditional knowledge associated with low external input agriculture. Bioprospecting of traditional crops and wild edibles can help us survive in the changing climate conditions.

Rudra Singh Butola
Tolma village

Woman farmer in the Indian Himalayas
©Shalini Dhyani

From supply chain to community – A Participatory Guarantee System for mountain farmers in Italy

Carlo Murer

Lack of confidence among consumers in third-party certification has prompted one Italian organics supplier to introduce a PGS to certify its products. The move is being piloted in Romagna, a partially mountainous region of northeastern Italy.

Monitoring the entire production chain, from farm to shop, is the best way of guaranteeing the quality of organic products, according to EcorNaturaSì, an Italian company specializing in producing and distributing organic products. But a series of scandals in recent years, which have received wide coverage in the media, has highlighted the need for a second level of quality assurance.

In response, the organics company has set up a PGS system based on regular visits to farms by a delegation that includes agronomists, food technologists and consumers. The strategy marks a shift in the basic PGS model, which is normally perceived as a tool in the hands of farmers to ensure the quality of their products, rather than one promoted by a distribution company.

A farmer feeding cows in Italy
©EcorNaturaSì Spa

By embracing a participatory approach to the selection of supplier farms and the monitoring of the production processes of products sold in the shops, the company hopes to build trust between producers and consumers, who increasingly want to know more about the food they eat and the culture behind its production.

Under this particular PGS, customers of EcorNaturaSì's shops are asked to actively participate in visiting farms, to select the most virtuous and to help in monitoring their production processes. The 20 farmers selected for PGS implementation have been enthusiastic about the experience, expressing the desire to work together, opening their farms to consumers and sharing their way of life. The company opted to launch the process in Romagna in 2019, partly because the community spirit is still present there and partly because mountain environments are naturally cleaner, with their forests, ecological corridors and natural features helping to maintain a balance with many pests, avoiding the need for chemical pesticides.

What	The key element for the PGS to work is to address the inherent need of people to know where the food comes from, in order to have a feeling of trust and safety regarding the food that they eat.
Why	The logic behind implementation of a PGS, for EcorNaturaSì, is the connection between the people who produce the food and those who eat it. The idea is to turn the linear concept of a supply chain, which sees farmers and consumers far apart on the two opposite extremes, into a model where farmers and consumers get to know each other.
Who	As well as involving farmers and consumers, the PGS in Romagna set out to involve all potential stakeholders, including agronomists, small-scale mills, bakeries and shopkeepers.
When	Farm visits are conducted once/twice a year by the delegation of PGS participants. The best time to visit farms is spring or early summer, when the crops are growing.
Where	Romagna is a partially mountainous region in northeastern Italy, with a strong agriculture sector. In the mountains of Forlì-Cesena province, the main crops are cereals such as soft wheat and spelt, or pulses such as chickpeas and lentils. Most of the farms here still have animals, mainly cattle, thanks to the availability of hay from meadows in the higher altitudes.

Figure 3: Overview of PGS implementation by EcorNaturaSì in Italy

Source: Case study author's own elaboration, 2020.

PGS members meet to discuss in Italy
©EcorNaturaSì Spa

Organic *aymaks* of Kyrgyzstan

Asan Alymkulov

It is widely acknowledged that there are large numbers of organic farmers in Kyrgyzstan, especially smallholders. However, many of them are unaccounted for, unrecognized and unrewarded – simply because they are not certified. Participatory Guarantee Systems are particularly suited to smallholders such as these, intertwining tradition and culture with quality assurance.

In Kyrgyzstan, the organic *aymak* is a model of integrated sustainable development for rural communities, combining the traditions of nomadic culture with the progressive achievements of modern civilization. It comprises a group of farmers, drawn from one or several villages in mountainous regions that have common sources of water and adjacent lands. These farmers have agreed on a voluntary basis to jointly develop their agriculture, based on organic methods and traditional knowledge.

Assisted by the Federation of Organic Development BIO-KG (FOD Bio-KG), a pilot project was introduced in 2013 in Koror-Bazar Organic *aymak*, with 40 farmers. By 2019, the initiative had been extended to include ten organic *aymaks* in various regions of Kyrgyzstan – two in Talas *oblast* (region), two in Nary *oblast*, five in Issyk-Kul *oblast* and one in Chui *oblast*, involving a total of 650 farmers (see Figure 4).

Since 2015, FOD Bio-KG has implemented a number of activities aimed at promoting organic agriculture in Kyrgyzstan and Central Asia. Its main work pillars involve capacity-building, advocacy, lobbying and research, with activities that include practical and theory-based training in organic agriculture, organic quality assurance, biological pest and disease management, fundraising and leadership. A key component of the strategy is the promotion of diversified crop growing, instead of or together with monoculture practices, to make products more resilient to market price fluctuations. Another is the quality assurance of products through PGS for the internal market, and helping farmers to establish such schemes.

Tradition is a key tool in uniting farmers within organic *aymaks*, and the same model has been used in establishing a structure to implement a PGS, and particularly to guarantee the sustainability of its activities. For this reason, the role of coordinating body is generally undertaken by elderly people, respected for their deep knowledge and experience of farming.

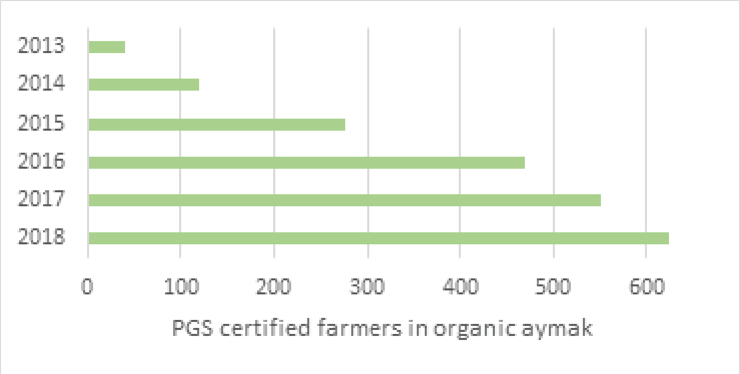


Figure 4: Number of PGS certified farmers per year

Source: FOD Bio-KG, 2020.

The Harvest Fest is a tradition to thank nature for a good harvest
©FOD Bio-KG

The PGS groups are based on mutual trust, with members firmly convinced of the value of organic farming as a healthy, compatible and affordable approach that is safe for today's generation and for those to come. In addition, the farmers have formed themselves into a legal entity, so as to reach a volume of products that can meet market demands.

Challenges include the need for record-keeping and documentation – practices that are new to many farmers. To simplify the process and avoid paper documentation, a mobile-based Akvo application has now been introduced for data collection and peer assessment. Although a key component of PGS initiatives is the constant learning process, at the beginning only 50 percent of members participated in training.

The Federation of Organic Development BIO-KG and the organic *aymak* farmers are also active at national level. They jointly campaigned against the construction of a plant producing chemical fertilizers in Kyrgyzstan and against gold mining in the Koror-Bazar organic *aymak.*

Future plans include integrating livestock into the verified organic farming system and building the capacity of new emerging groups. According to the collected data, about 61 percent of farms are managed by women and more young people are becoming involved in rural agricultural entrepreneurship. For this reason, organic *aymaks* will need to develop and systematize strategies for ensuring that youth and women play a greater role. On the demand side, more marketing, awareness-raising and strong branding are required, while on the production side, there is a need for support to new producers, processors and related support services.

Using organic farming and the crop rotation method, I started planting various seeds. People don't believe that I earn more now, on this small piece of land, than on the several hectares I had before! This is all because of the comprehensive trainings conducted within the project framework by BIO-KG.

Turdubekov
a 53-year-old farmer from Tüp
raion district in Kyrgyzstan

Organic festival in Kyrgyzstan
©FOD Bio-KG

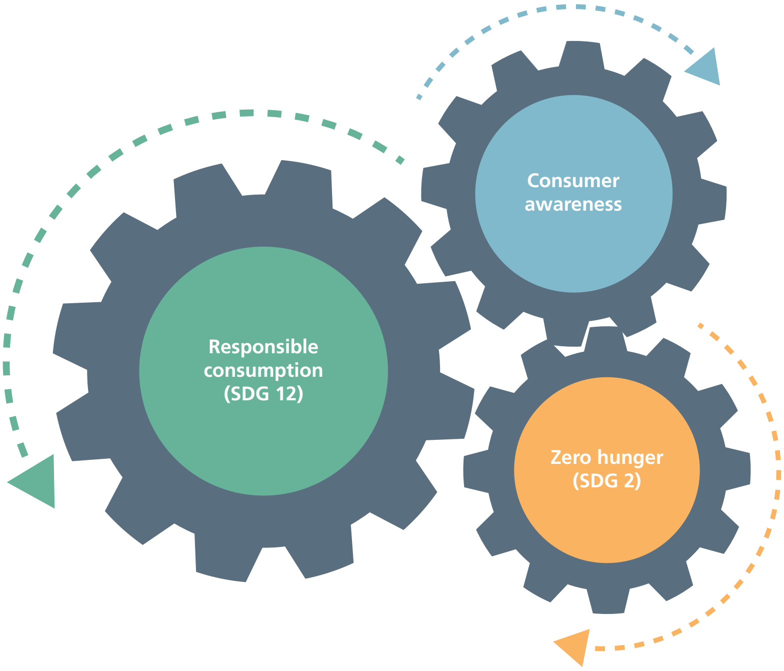
Farmers' markets build solidarity in Lima

Liza Melina Meza Flores

Farmers' markets are becoming an increasingly familiar sight in the Peruvian capital. They are attracting a new range of consumers, who are flocking to these freshly created spaces and engaging directly with producers. In this way, the landscape of Lima is gradually changing, and, at the same time, consumers are increasing their environmental awareness and solidarity with small-scale farmers.

Ecological farmers' markets are proving successful platforms for changing consumer patterns, serving as entry points for raising awareness about food products and the people behind them. As a result, such markets are emerging as the foundation for an economy based on solidarity between consumers and producers, strengthening the urban-rural connection.

To test this theory, an evaluation was conducted by the Project Coordinator at Fondo de las Américas (FONDAM) NGO, in order to strengthen the technical capacities for the development of food value chains of rural development projects financed by the NGO. For this, ecological farmers' markets in Apurimac and Lima were visited, where semi-structured observations and interviews were conducted, and their social media activities were monitored.



The study revealed:

- Institutional arrangements: In Peru, there is a strong "bargaining" culture, but this was surprisingly absent during the market visits.
- Socio-economic conditions: Familiarity between producers and consumers creates an understanding and recognition of each other's realities.
- Physical environment: Consumers finally acknowledge producers' inherent vulnerability to climate change and the challenges of supplying products for the food system.

In these markets, capacity-building events are held on a regular basis, with experts presenting simple activities that can be practised at home, even in an urban setting, such as composting, reducing waste, reusing non-recyclable materials and urban gardening. In addition, small-scale farmers often make presentations to raise awareness about their living and working conditions. Small-scale processors share knowledge about the nutritional properties of native foods and the benefits of processed foodstuffs that use native inputs (such as quinoa milk). Chefs teach different recipes using well-known but also neglected and underutilized plants (such as lupin). If consumers do not know how to prepare a tasty meal, then they are unlikely to purchase the ingredients.

This type of interaction in the markets has brought producers and consumers closer together. The new bond of solidarity was highlighted during landslides and floods in the summers of 2018 and 2019. As a result of these events, access to several main roads in rural areas and all highways to cities was reduced or totally blocked, causing an increase in transaction costs. In these difficult times for small-scale farmers and processors, consumers organized support by sending them clothes, waterproof boots, bottles of water and blankets, among other essential items.

Building trust with consumers is crucial if they are to accept organic products, and that generally requires some form of quality assurance system. In June 2019, Peruvian Law 29196 gave PGS the same status as third-party certification for organic products. The move promised to be an advantage for smallholder farmers, for whom third-party certification is complicated, expensive and time-consuming. However, the new law also makes it complicated, expensive and time-consuming for small-scale producers to obtain PGS authorization, leaving small farmers with the following challenges:

- Technology and technical assistance are expensive.
- There are no formal links between academia and small-scale farmers and processors to promote co-creation of knowledge.
- Inappropriate infrastructure keeps transaction costs high.
- Trust in the PGS and how it is managed is key if consumers are to pay premium prices for products. But the PGS is time-consuming, necessitates technical assistance, is often expensive and requires recognition by law.

- Currently, these markets are located in wealthy districts, whose inhabitants can pay above-market prices. In order to achieve the SDG 2 of "Zero hunger," the strategy should include making available healthy and nutritious products to the most vulnerable communities in the outskirts of Lima.

Ecological farmers' markets[3] are places of interaction and learning, creating synergy among actors in the food system, and building a community. Policies must be adapted or designed to support small-scale producers and processors, and consumers need to be aware and to act responsibly. Change will follow, as a result of public pressure on the government, or through consumers' own direct action, by paying a fair price to producers.

An agroecological fair in Barranco, Peru
©Liza Melina Meza Flores

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[3] **Feria Agroecológica Chakramanta in Abancay:** www.facebook.com/watch/?v=2321945651373604
Feria Ecológica de Barranco in Lima: www.facebook.com/feriaecologicabarranco/
Interview with the Managing Director of Agroferias Campesinas in the official newspaper of the Government of Peru. Agroferias Campesinas is one of the visited farmers' markets: https://elperuano.pe/noticia/83135-mercado-de-productores-para-unir-el-campo-y-la-ciudad
Ferias Frutos de la Tierra: www.facebook.com/Proyecto-Frutos-de-la-Tierra-220030798485795/
Feria Peruanos Naturalmente: www.facebook.com/events/448190125956686/
Festival Conservamos: www.facebook.com/events/2279128745507548/

Farm in Yunnan, China
©Clément Rigal - Cirad/Icraf

5

Strengthening local community initiatives by building alliances

Mountain family farming: where economic, environmental, social and cultural functions co-evolve

Agroforestry in Yunnan, China
©Clément Rigal - Cirad/Icraf

Svea Senesie

Family farms produce more than 80 percent of the world's food, while also improving the environmental sustainability of agriculture, conserving and restoring biodiversity and ecosystems, as well as providing traditional and nutritious food. The UN Decade of Family Farming (DFF, 2019–2028) is a major opportunity to highlight the role of smallholder, supporting the design and implementation of comprehensive economic, environmental and social policies for a conducive environment to strengthen the position of family farming.

Priorities of the DFF action plan encompass the development of an enabling policy environment, support to youth and the promotion of gender equity in family farming and the leadership role of rural women. In addition, family farmers' organizations and capacities need to be strengthened to improve socio-economic inclusion, ensuring resilience and well-being for family farmers, and contributing to territorial development and food systems that safeguard biodiversity, the environment and culture.

The Forest and Farm Facility (FFF) provides support to empower the collective action of forest and farm producer organizations (FFPOs), helping them to increase their advocacy skills to achieve recognition for their rights, to enhance their technical and business capacities to play a role in mitigating and adapting to climate change, and to improve food and nutrition security. The Facility has already reached more than 947 FFPOs in 10 partner countries (Plurinational State of Bolivia, Gambia, Guatemala, Kenya, Liberia, Myanmar, Nepal, Nicaragua, Viet Nam and Zambia) since 2012. In Viet Nam, the FFF is working with family farming households in 12 mountainous communes in Bac Kan, Yên Bái, Hoa Binh and Son La (see p. 82 for more detail).

Using ethnobotany to refine agroforestry tools in Yunnan, China

Clément Rigal, Jianchu Xu and Philippe Vaast

Awareness of the link between conventional agricultural practices and environmental degradation is increasing. The repercussions are even more serious for smallholder farmers, who are among the most vulnerable to market fluctuations and climate change. In Yunnan Province, China, local governments and researchers are partnering to deliver sustainable agroforestry solutions to coffee farmers, aimed at both protecting the environment and safeguarding indigenous livelihoods.

Yunnan Province is the leading coffee-producing area in China, with more than 100 000 ha of Arabica coffee farms. Production saw a boom in 1990, in the wake of domestic economic reforms. Farming systems (monocultures in full sunlight) and management practices (high fertilizer inputs) were designed for high yields, but rising production figures came at the expense of environmental sustainability, biodiversity conservation and soil health.

Adding fertilizer
©Clément Rigal - Cirad/Icraf

To address these concerns, in 2012 local governments in southern Yunnan Province implemented a large-scale campaign to convert monoculture coffee systems into agroforestry systems. Drawing on a growing body of evidence that shows the importance of shade trees in sustainable coffee production systems and the multiple ways in which they buttress climate change resilience, local extension leaders selected a dozen such species and distributed free seedlings to all coffee farmers. In southern Yunnan, the transition to agroforestry rapidly increased soil and biological fertility, offered protection to coffee trees from climatic hazards and maintained high coffee yields.

However, local extension services did not take advantage of farmers' first-hand experience and did not therefore tailor their solutions to individual farmers' needs. The Centre for Mountain Futures, in collaboration with World Agroforestry Centre (ICRAF) and the Kunming Institute of Botany illustrated the feasibility of a bottom-up approach in selecting and promoting shade tree species. At the core of this approach lies the idea that all farmers possess local ecological knowledge (LEK) regarding the effects of several shade tree species on their coffee farms. This LEK combines traditional knowledge and first-hand experience of working in emergent coffee-agroforestry systems. The comprehensive aggregation and consolidation of farmers' LEK can strengthen scientific research into shade tree species selection.

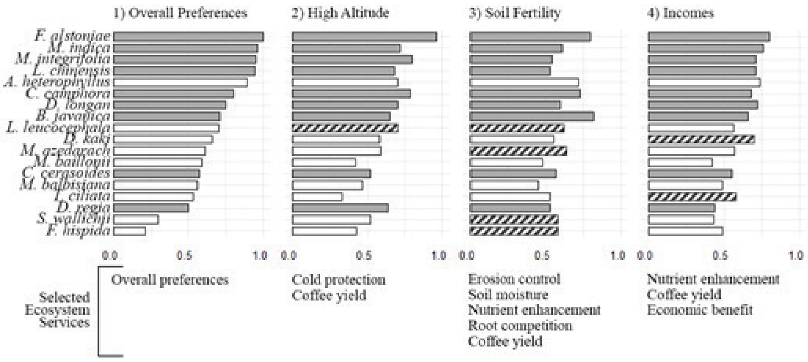

Figure 5: Tool outputs displaying scores for 18 shade tree species out of 30 according to four scenarios: 1) overall preference; 2) a high altitude farm exposed to frost risks; 3) a farm with limited or no input of chemical fertilizers; and 4) a farm where trees are primarily planted and managed for income diversification. Grey boxes indicate promoted species; striped boxes indicate non-promoted species that score highly in a specific scenario.

Source: Rigal *et al.,* 2018.

For the study, 143 coffee farmers were interviewed to assess their perceived impacts of the most abundant shade tree species. Interviewees were selected across a wide range of ages (from 23 to 62 years) and ethnic groups in the area, while also aiming for a representative gender mix. The analysis resulted in a database of scores reflecting the perceived performances of 30 shade tree species across nine dimensions: i) allowing high coffee yields; ii) bringing additional economic benefits, such as fruits, timber, etc.; iii) protecting coffee trees from frost; iv) protecting coffee trees from heatwaves; v) suppressing weeds; vi) enhancing soil fertility via improved nutrient cycling; vii) enhancing soil moisture; viii) limiting soil erosion; and ix) limiting root competition. For example, *Leucaena leucocephala* scored close to the maximum score of 1 for coffee yield. This means that, according to farmers, this shade tree species leads to higher coffee yields under its canopy than most other tree species studied. On the other hand, the same species scored close to the minimum score of 0 with respect to additional economic benefits. This means that, according to farmers, this species brought less economic income than most other trees studied.

This LEK-based approach generated comprehensive results for a large set of shade tree species and ecosystem services. These indicate that most coffee farmers appreciated the dozen tree species selected by local governments, particularly those with the potential to protect coffee trees from climate hazards and which offered significant economic benefits. Some of these latter were the result of additional fruit production or the transplanting of more mature trees into urban environments for green marketing campaigns. Two other shade tree species were widely praised by most coffee farmers – *Artocarpus heterophyllus* and *Leucaena leucocephala* – but they widely dismissed indigenous timber trees with strong potential for providing ecosystem services, such as *Michelia baillonii* and *Toona ciliata*, due to difficulty in securing timber harvesting permits.

While the data have significant policy implications for informing the future context-specific selection of seedlings for distribution to coffee farmers, gaps still exist at farm level. To bridge this, the database was integrated with an online decision-making tool that can tailor shade tree species recommendations, based on farmers' individual needs. To illustrate the point, if you farm at high elevations and seek shade tree species that can enable high coffee yields, protect coffee trees from frost and enhance soil moisture, the tool will identify species that provide the best trade-off among these three objectives. Taking into account fine-scale contextual variations, this tool paves the way for refining efforts to promote agroforestry systems. The next step is to incorporate its use into public and private delivery service models to bring tangible benefits to the coffee farmers of southern Yunnan.

Local ecological knowledge-based results are only relevant locally, but the methodological approach used in this study is applicable globally. For example, similar results have recently been released regarding shade tree species provision of ecosystem services in coffee-agroforestry systems in the United Republic of Tanzania and Uganda. Results from such studies feed into the growing online database of shade tree species and their provision of ecosystem services, expanding the influence of the online tool, enlarging the scope of this kind of research and bringing its benefits to farmers in need around the world.

Resilient practices for large cardamom agroecology in Nepal

Surendra Raj Joshi and Nakul Chettri

Large black cardamom is an important cash crop for marginal farmers in the Eastern Himalayas. It is ecologically native, involves little workload and is not dependent on high external inputs. However, climate change and lack of product profiling have increased risks for farmers. This intervention focused on developing a package of practices (POP) to reduce risks and build resilience.

Large black cardamom (*Amomum subulatum Roxb.*), native to the Eastern Himalayas, is widely grown as a cash crop in Bhutan, Nepal, and the northeastern states of the Indian Himalayas. It is a high-value, low-volume crop that grows well on marginal lands and favours agroforestry systems suited to mountain environments. The product is a boon for farmers and a primary export commodity in the region, with national and local governments prioritizing its production and promotion. In recent years, the area under large cardamom has increased exponentially due to high returns and increased market demand. However, substantial fluctuations in both yields and market prices have led farmers to explore more sustainable modes of production and trade. These swings are due to two broad challenges:

- **Climate change**: Extreme climate events, erratic rainfall, increasing pests and disease, hailstorms and snowfall have impacted traditional management practices and the crop cycle. For example, flowering and harvesting times have changed due to rising temperatures and a decline in pollinators, resulting in reduced fruit setting.

Water storage for irrigation of large cardamom crop during dry season
©Nakul Chettri

Improved dryer for improving quality of pods and reducing use of fuelwood
©Nakul Chettri)

- **International competition and volatile market:** Several plants in the genera *Amomum*, *Elettaria* and *Aframomum*, all belonging to the Zingiberaceae family, are referred to as cardamom, though they have different local names and their taste, aroma and chemical compounds vary greatly. Cardamom is often described as green, white, black or red based on the appearance of the dried fruit, and indexed to fruit size/form such as small, large and round. The green or small cardamom (*Elettaria cardamomum*) is cultivated in Guatemala, India, Sri Lanka and other tropical countries; large black cardamom (*Amomum subulatum Roxb*.) is a particular species of cardamom grown only in Bhutan, India and Nepal. Though overall demand for cardamom has increased over the years, the expansion of cardamom plantation area in other countries has led to increased competition and a drop in international market prices. Large black cardamom from the Eastern Himalayas has to compete in price with green, white and large cardamom, as it is not differently positioned in the international market. However, most data on international trade in cardamom, market actors and use are generic. At the same time, the increased dependency on large cardamom poses higher risks to farmers due to production fluctuation and volatile markets. For example, in 2014, large cardamom capsules in Nepal fetched USD 28 per kg, and dropped to USD 10 per kg in 2017.

To address these challenges and improve the livelihoods of communities involved in large cardamom agroforestry, the International Centre for Integrated Mountain Development (ICIMOD), together with partners, co-developed a package of practices and demonstrated it in Taplejung district, Nepal. The POP is based on series of field studies, observations, interactions and literature review, and integrates climate-smart practices and innovations developed in different pockets of the Kangchenjunga landscape. It focuses on (i) diversification of income sources by integrating honeybees, legumes and fruit trees on large cardamom farms; (ii) understanding ecosystem services and ecosystem management, with community-led microplans and collective actions; (iii) strengthening market

One way to respond to climate change is more income for large cardamom farmers so they have more options; this farm is a fantastic example of that.

David Molden
former Director General of
ICIMOD

linkages and enterprise development; and (iv) demonstrating climate-resilient farming practices, such as effective and efficient use of water, renewable energy, crop management as per weather forecasts and climate services, green manures, vermicompost, replacement of old shade trees, and access to services and information on market prices and crop advisories.

Strong emphasis is placed on strengthening institutional linkages, community mobilization and capacity-building to ensure sustainability. In partnership with social enterprises, community members are being trained to make value-added products from cardamom pods, such as cardamom powder, cardamom biryani masala, and cardamom tea mix. Traditionally, the cardamom stems are discarded, but following training a number of entrepreneurs have begun using cardamom fibre to weave products such as tablemats. In addition, an SMS-based information service now connects farmers to market prices, weather forecasts and crop advisories.

Comparison of large cardamom production (kg)

Categories	Baseline 2015	End line 2018	Difference (Significant at 1%)
Beneficiary households (n136)	100.57	153.64	53.06***
Non-beneficiary households (n115)	107.38	106.83	-0.54
Difference	-6,81	46.81**	DiD=53.60***

Figure 6: Comparison of large black cardamom production.[4] The production for non-beneficiary households remained stagnant between baseline and end line; however, production increased by 53 kg among beneficiary households and this increment is statistically significant at 1%.

Source: Case study authors' own elaboration, 2020.

The baseline and end line surveys, conducted in late 2015 and early 2018 respectively, showed high uptake of the POP by target communities, and a significant reduction in loss among target households compared with the non-target ones. There are opportunities for transboundary collaboration to promote large cardamom as a regional product through coordinated research, technology exchange for improved yields, building organized markets and infrastructure, and developing compatible regional policies. The next step will be to position large cardamom as a niche product with coherent regional standards, by informing market actors about its unique attributes. Bhutan, India and Nepal have prioritized large black cardamom as a valuable foreign exchange-earning export commodity. Nepal has listed it in its National Trade Integration Strategy (2010–2015 and 2016–2020). Bhutan has included large cardamom as an important product under its "One Gewog One Product" policy, and the Government of Sikkim has placed great emphasis on promoting this crop to support rural livelihoods. Regional stakeholders are now planning to position large cardamom as a product with unique attributes through collective action and a common marketing approach, backing this up with a Geographical Indication certificate.

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[4] DiD stands for Difference in differences, which is calculated using the formula: (C-D)-(A-B); where C is end line figure of beneficiary households, D is end line figure of non-beneficiary households; A is baseline figure of beneficiary households and B is baseline figure of non-beneficiary households. The asterisks denote significance level, set before data collection: *** Significant at 1% and ** 5%. The significance level is the probability of rejecting the null hypothesis when it is true. For example, a significance level with *** indicates a 1% risk of concluding that a difference exists when there is no actual difference.

Participants in Rasuwa MAPs training, transplanting rhizomes of Satuwa
©Alisa Rai

Cultivated species help to protect wild plant resources in high Himalayan communities

Umesh Basnet, Jesse Chapman-Bruschini and Alisa Rai

For centuries, mountain people in Nepal have traded valuable medicinal and aromatic plants across the Himalayas. However, intense pressure from wild harvesting is threatening these species' survival. In partnership with remote highland communities, The Mountain Institute (TMI) has developed nature-based solutions to improve livelihoods and offer a profitable alternative to traditional wild harvesting.

As key ingredients in Ayurvedic and traditional Chinese medicines, medicinal and aromatic plant (MAP) products from the Nepalese Himalayas have long been wild-harvested, transported and traded across boundaries. Most MAPs come from wild harvests and end up mostly in India, with lesser amounts destined for China and a few western countries. In recent decades, increasing global demand for Nepalese non-timber forest products has played a major role in over- and unsustainable harvesting, resulting in the rapid depletion of wild MAPs, even in protected areas.

As of the early 1990s, the impact of over-exploitation could be clearly seen in eastern Nepal, where species such as Chiraito (*Swertia chirayita*), Satuwa (*Paris polyphylla*), Bikhuma (*Aconitum* spp.) and Loth salla (*Taxus wallichiana*) were on the verge of local extinction. In response, TMI carried out a reconnaissance study and found that unsustainable harvesting of MAP species represented between 10 and 50 percent of rural households' annual cash income, and that strong market demand was driving the increase in wild harvesting. In 2000, TMI began its Medicinal and Aromatic Plants Program, with a focus on training mountain farmers to cultivate medicinal and aromatic plants on their own plots and on degraded land, instead of relying on wild harvests. Mountain farmers adapted quickly, learning to cultivate MAPs on the edges of steep mountain terraces and intercropping medicinal plants with other cash and food crops.

Training workshops are held to build both technical skills and practical knowledge among interested farmers. Each trainee is given seeds or rhizomes for specific MAP species and taught practical cultivation skills. Medicinal and aromatic plant cooperatives are established and legally registered to support enterprise development, quality assurance and equitable benefit sharing. Additional training and workshops on cooperative management and business development planning help to enhance the cooperatives' ability to access financing and develop a business strategy.

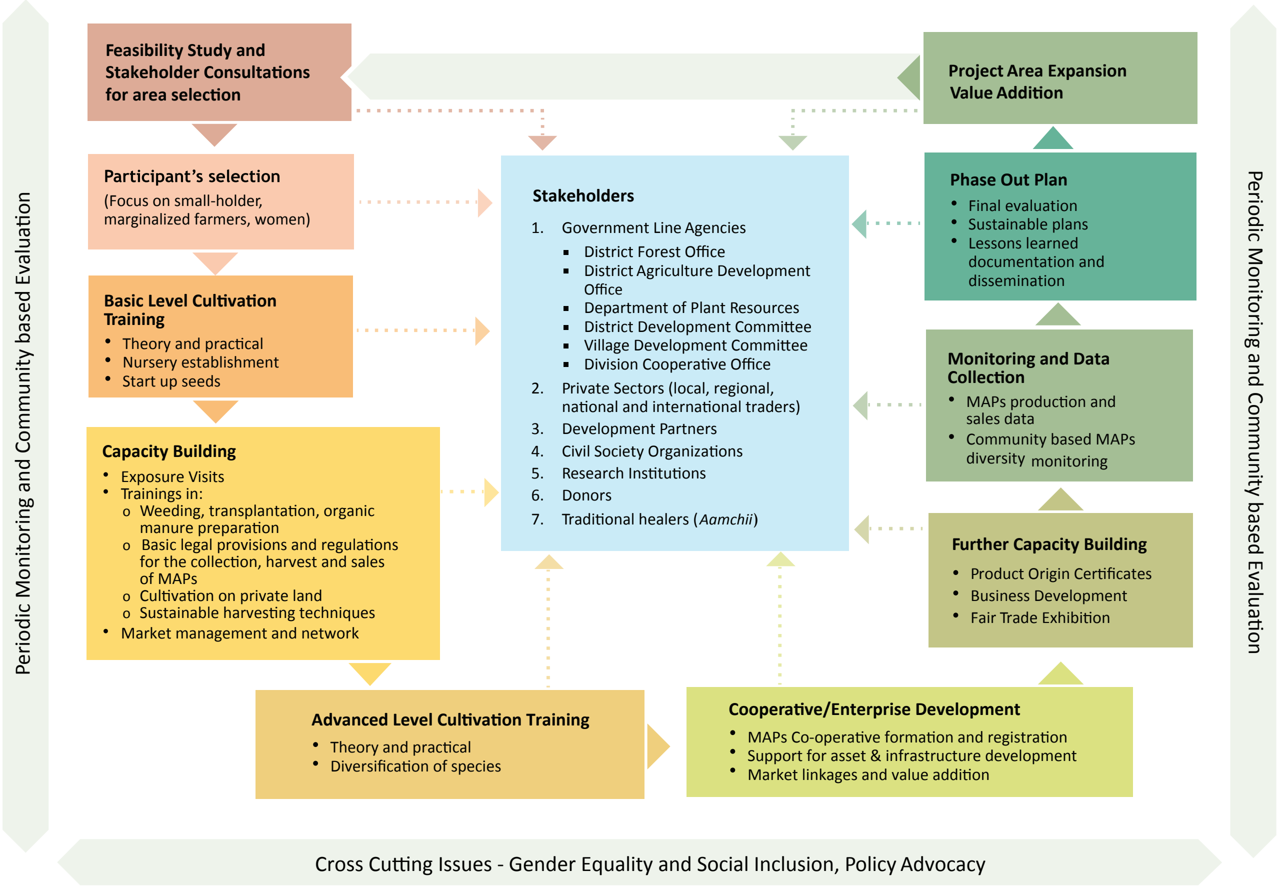

Feasibility Study and Stakeholder Consultations for area selection
Project Area Expansion Value Addition
Participant's selection
(Focus on small-holder, marginalized farmers, women)
Basic Level Cultivation Training
• Theory and practical
• Nursery establishment
• Start up seeds
Capacity Building
• Exposure Visits
• Trainings in:
o Weeding, transplantation, organic manure preparation
o Basic legal provisions and regulations for the collection, harvest and sales of MAPs
o Cultivation on private land
o Sustainable harvesting techniques
• Market management and network
Stakeholders
1. Government Line Agencies
▪ District Forest Office
▪ District Agriculture Development Office
▪ Department of Plant Resources
▪ District Development Committee
▪ Village Development Committee
▪ Division Cooperative Office
2. Private Sectors (local, regional, national and international traders)
3. Development Partners
4. Civil Society Organizations
5. Research Institutions
6. Donors
7. Traditional healers (Aamchii)
Phase Out Plan
• Final evaluation
• Sustainable plans
• Lessons learned documentation and dissemination
Monitoring and Data Collection
• MAPs production and sales data
• Community based MAPs diversity monitoring
Further Capacity Building
• Product Origin Certificates
• Business Development
• Fair Trade Exhibition
Advanced Level Cultivation Training
• Theory and practical
• Diversification of species
Cooperative/Enterprise Development
• MAPs Co-operative formation and registration
• Support for asset & infrastructure development
• Market linkages and value addition
Periodic Monitoring and Community based Evaluation
Periodic Monitoring and Community based Evaluation
Cross Cutting Issues - Gender Equality and Social Inclusion, Policy Advocacy

Figure 7: The Mountain Institute's Cultivation, Commercialization and Conservation of Medicinal and Aromatic Plants (MAPs) Program
Source: TMI, 2020

The Mountain Institute has also supported site visits to China and India and to establish market linkages for farmers' cooperatives. Medicinal and aromatic plant farmers are assisted in obtaining Product Origin Certificates to certify that their MAPs are not collected from the wild.

With the help of local community groups and NGOs, the MAP initiative has now expanded to encompass 100 villages in 11 mountainous districts of eastern, central and western Nepal. More than 18 000 farmers are currently cultivating MAPs, and between 35 and 40 percent of them are women. By training their neighbours and relatives, MAP farmers have greatly increased the programme's reach and impact over the years. More than 2 500 ha of private and degraded land are under cultivation with 13 different MAP species. MAP storage depots and collection centres have been established, along with community managed MAPs and fodder nurseries. The income of individual farmers from selling MAPs has ranged from USD 300 to USD 35 000 per year. Now, as well as working to spread the initiative throughout regions of Nepal, TMI is promoting the MAP approach in the Peruvian Andes. Implemented by local communities, the programme is already beginning to produce results for local highland producers and the resources on which their future depends.

Farmer-turned-entrepreneur Phinsum Sherpa, 59, is one of the lead MAP farmers in Kimathanka village, near the Tibetan border in Sankhuwasabha district. In 2015, she purchased a flour grinding machine with money earned by selling MAPs grown in her field. With the earnings from MAPs and her new enterprise, she has been able to send her son to Kathmandu for Buddhism Studies and one of her daughters to the district headquarters for higher education.

Goba Jamyang Bhotia and his wife Chhijik, both 58, of Chyamtang village, have been cultivating Chiraito (*Swertia chirayita*) on a 0.2 ha plot. Before, Goba made money from wage labour, but this income was not sufficient to feed his family. Last year, the couple made enough money from MAP sales to replace their old bamboo mat roof with a new blue metal one. With their upcoming MAP income, they hope to help send their grandchildren to the new private boarding school in nearby Lingam, which offers a better education than government schools.

Food from farm and forest, a case study from Kailash Sacred Landscape

Kamal Prasad Aryal, Ram Prasad Chaudhary and Sushmita Poudel

People living in the Kailash Sacred Landscape in Far Western Nepal depend significantly on crop diversity, both cultivated and wild, for food, nutrition and income. Nearly 85 percent of households also rely exclusively on wild and non-cultivated edible plants for one or more months of the year. Conservation of this unique agroecological system is crucial for the future of this food-insecure region.

The Kailash Sacred Landscape is a transboundary area shared by Nepal, India and the People's Republic of China. It is home to several ethnic and linguistic groups and is rich in biodiversity, particularly agricultural crop and wild genetic diversity. However, documentation is poor regarding these resources' availability, use, contribution to livelihoods and household food security, and the engagement of household members in conserving and managing diversity.

Many districts in the mid-hills and mountains of Far Western Nepal are in food deficit and score the lowest on the Human Development Index for regions within Nepal. In a context characterized by high poverty rates and chronic food and livelihood insecurity, there is a high level of outmigration, mostly of men.

A study undertaken by ICIMOD in Khar Village Development Committee, Darchula district, investigated the diversity of cultivated and wild crops, their use, their role in and implications for livelihoods, and local perceptions on conservation and management differentiated by gender.

Women at a stall during the crop diversity fair in Khar
©ICIMOD/Pradyumna Rana

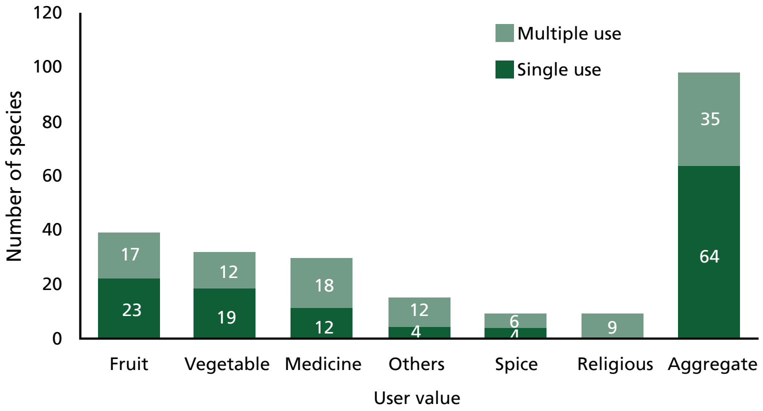


Figure 8: Use of wild and non-cultivated edible plants
Source: Case study authors' own elaboration, 2020.

The study documented 88 crops (vegetables, spices, fruits, beans and pulses, cereals and pseudo cereals) and 235 varieties from 37 botanical families. The highest varietal diversity within major crops was recorded in maize, followed by paddy, wheat and beans. However, only 5 percent of households were able to meet their annual food requirement from their own production; the remainder were only food self-sufficient for 10 months or less. Households adopted multiple coping strategies during the food deficit months, including seasonal migration for work to the district headquarters and to parts of India, sale of agricultural and livestock products, collection and sale of *yartsa gunbu*, the caterpillar fungus (*Ophiocordyceps sinensis*), and collection of wild and non-cultivated edible plants (WNEPs). Besides cultivated crops, the study recorded 101 WNEPs belonging to 60 botanical families. Importantly, nearly 85 percent of households depend exclusively on WNEPs for at least one month of the year.

However, there is erosion and loss of this crop and wild diversity due to the introduction of hybrids, outmigration, the easy availability of other foods, and the seasonal movement of entire villages in search of *yartsa gunbu*.

Wild edibles, crucial during times of food shortage, have the potential to become important alternatives to the usual vegetable crops cultivated by farmers. The study also showed that farmers prioritize those species that provide multiple benefits, such as food and nutrition security, as well as household-level health care. It is

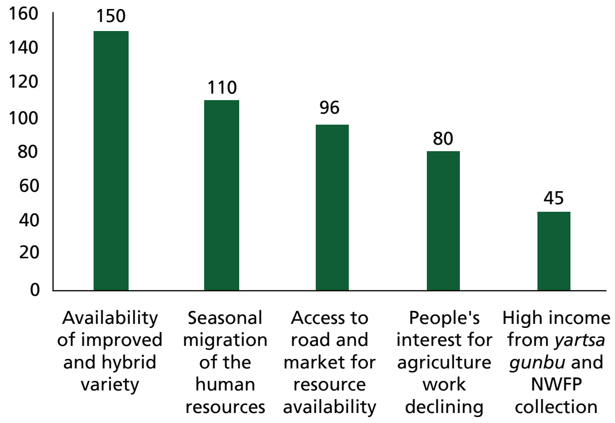


Figure 9: Reasons for the decline of traditional crops
Source: Case study authors' own elaboration, 2020.

Discussing rice variety traits with a farmer in Khar
©ICIMOD/Pradyumna Rana

important that government interventions are designed to conserve this diversity. That could mean developing conservation and restoration plans with an explicit focus on species crucial to household nutrition and health. Domestication in home gardens could be a good starting point for some species, as they offer increased availability of water, a mostly organic-based production system, easier protection against predators and close monitoring by household members.

Changing food habits, taste and lifestyles and the availability of ready-made foods in the local market are contributing to the growing neglect of traditional foods in rural diets. Integrated research and development, including product diversification and marketing of these crops, is needed to promote the conservation of diversity and ecosystems, and secure better returns for producers.

Local people must be involved in the conservation and management of crop diversity, as they are both the guardians and users of the resources and have the greatest knowledge of them. The study highlighted the role of women as seed keepers and the importance of conserving this diversity. It is essential that government and civil society interventions aimed at improving the food security of the Far Western Region place women and their concerns at the centre of research and extension.

When I was growing up, we used to cultivate a diversity of traditional crops like finger millet, amaranth, foxtail millet, proso millet, barley and buckwheat. Everyone loved finger millet, buckwheat and maize bread back then. Our own production was sufficient for our family, and we didn't depend upon the market for our food.

People have stopped planting traditional local varieties such as millets, amaranth and barley. It is even hard to find the seeds of these varieties now. Eating rice is considered modern, while eating millet is considered a sign of backwardness. Programmes such as these will help us conserve traditional seeds. Perhaps my grandchildren will be able to utilize these crops in the future.

Jaymati Badal,
77, a resident of Khar, Darchula,
belongs to a women's group that
collected seeds, fruits and other
plants

Energizing mountains – Solar power for organic Nepali apples

Menila Kharel, Renuka Rai and Pooja Sharma

Recently, many smallholders in Nepal's Jumla District have been hard hit by drought. Solar-powered irrigation, a climate-adaptive technology, is now helping these producers to irrigate their lands and increase organic apple production.

In Jumla District, more than 85 percent of mountain smallholders make their living from rainfed agriculture, with women accounting for over 60 percent of the agricultural workforce. This mountainous area, which was declared Nepal's first organic district in 2007, is popular for products such as organic apples, an indigenous variety of rice called *marshy*, Jumla beans, walnuts and a range of medicinal herbs. Organic farming is not merely an economic activity for these mountain smallholders. It is a way of life.

Organic apples are a key source of income for mountain smallholders in Jumla, but strong demand in urban markets has proved difficult to supply. Irrigation is a major challenge, albeit increasingly necessary given the growing impacts of climate change, especially erratic rainfall and drought. Despite an abundant source of water provided by the nearby Tila River, lack of technology means that smallholder farmers had no reliable source of irrigation. Women carried water manually from the river to irrigate their lands, which took a heavy toll on their health and well-being.

To address this acute shortage of water, a solar-powered irrigation system has been introduced in Jumla. Implemented as part of the Building Inclusive and Sustainable Growth Capacity of CSOs in Agriculture and Forest Sectors project – a joint initiative of the European Union, Jersey Overseas Aid and Practical Action – the

Organic apple farming in Dhaulapani Jumla
©Archana Gurung

Solar-powered irrigation under BICAS project in Jumla
©Archana Gurung

technology involved setting up pumps powered by renewable energy, with a view to generating evidence for its upscaling through public and private investments.

During the project period (2017–2019), a total of five solar-powered irrigation systems were demonstrated along the banks of the Tila River. These produced 20 000 litres of water per day, which was collected in storage tanks and distributed to fields as needed. The systems are now irrigating 8 ha of land and directly benefiting 130 households.

Working together with the local municipality and a private company – which provided technical support for the installation of pumps and training to local people for repair and maintenance – the project adopted a pay-for-water scheme as a business model, with households paying a nominal monthly fee for water use. The amount collected is deposited at a bank to pay for system maintenance, ensuring sustainability.

Aside from the irrigation technology, the project has also helped to strengthen the local knowledge system required for organic agricultural production, providing vegetable seed support, training in improved farming practices, a farmers' business school to enhance entrepreneurship skills, and climate field schools to sensitize farmers on climate change and climate-adaptive farming practices. Assistance was also given in building market linkages and networking with municipal government and other stakeholders.

Smallholders now have access to sufficient water for irrigation, livestock and domestic use. As a result, an additional 2 500 apple seedlings have been planted in Dhaulapani and smallholders have expanded their organic apple orchards and begun intercropping, producing both seasonal and off-seasonal organic vegetables for commercial sale. The increased and timely availability of water has improved both the production and quality of the organic apples and vegetables that they grow.

The solar-powered irrigation systems have drastically reduced women's workloads, leading to improvements in their health. Household nutrition has also benefited, due to higher incomes, resulting in a better quality of life for mountain communities. The increased opportunities for organic agricultural production have reduced seasonal migration. Men have started returning home and many are now working together with women to advance organic agriculture and other income-generating activities.

Creating an enabling environment for public and private investment in climate-adaptive practices and technologies will be critical to maintaining the momentum of these mountain farmers in practising organic production. The Jumla brand of organic apples is well known in Nepal, and the progress made so far heralds strong potential for the district to diversify its apple products into the production and marketing of juice, wine and dried chips, ensuring that the benefits of solar-powered irrigation extend well into the future.

Organic family farming helps to protect watershed in Panama

Alberto Pascual

The diversified agroecological production of fruit and vegetables is key to guaranteeing livelihoods for family farmers and the sustainable use of the upper part of the Santa Maria River Watershed in Panama. Practices by smallholder mountain farmers to safeguard agrobiodiversity in Santa Fe are contributing to climate change adaptation and water resource conservation for upstream and downstream communities.

Located in the upper part of the Santa Maria River Watershed, Panama's mountainous district of Santa Fe, with altitudes of over 1 900 m, plays a critical role in regulating the hydrological cycle and conserving biodiversity. Family farmers living in this area make an important contribution to this watershed, which supplies water to more than 200 000 people in three provinces: Veraguas, Coclé and Herrera, and to one part of the indigenous region Ngäbe-Buglé. The mountains of the upper part of the Santa Maria River Watershed host two protected areas – the Santa Fe National Park (72 636 ha) and the La Yeguada Forest Reserve (7 090 ha).

Since 2019, local NGO Fundación Comunidad has been working with 20 organic family farmers to implement a PGS in the watershed, with the aim of promoting sustainable development and mountain products. At the core of this initiative lies a family farm, Finca Orgánica Maria y Chon, established by husband and wife Encarnación and Maria Rodríguez 42 years ago. The farm has a total 3 ha, including 1 ha for flower and fruit cultivation and 2 ha of forest reserve, which contains mahogany trees (*Swietenia macrophylla*) planted 30 years ago to protect groundwater sources for irrigation.

Woman farmer in Panama
©Fundación CoMunidad

Finca Orgánica Maria y Chon is divided into several plots, where more than 60 local varieties of orchids are grown, as well as Arabica coffee and other crops. Maria makes jams from mango and banana, together with concentrates from seasonal fruits. The farm also offers accommodation for tourists.

The couple have obtained government organic certification for three crops: citrus, banana and vegetables, whose total production was 11 477 kg in 2018. Other crops grown on the farm include chili peppers, broccoli, onions, green beans, lettuce, criollo mandarins, Valencian oranges, cucumbers, paprika, beets, cabbage, tomatoes and carrots.

This organic family farm is linked to traditional farming systems, where biodiversity is protected through polyculture and agroforestry. Encarnación and Maria use crop rotation techniques, and integrate worm and bokashi composting as organic fertilizers for soil conservation.

Family farmers such as this couple play a fundamental role in the sustainable management of natural resources. At the same time, they are strengthening the adaptive capacities and building the resilience of mountain ecosystems to the potential impacts of climate change.

Panama has made significant progress in promoting family farming in recent years. In 2018, in collaboration with FAO, the government published a National Plan for Family Farming, outlining areas for targeted support, including governance, finance, insurance, research and marketing. In January 2020, prospects for a more vigorous family farming sector advanced a step further, when a law based on this strategy was approved for implementation.

Coffee trees in the nursery
©Fundación CoMunidad

The Carpat Sheep project in Romania – It all starts with the grass!

Andrei Coca, Ioan Agapi and Peter Niederer

This Swiss-Romanian cooperation initiative seeks to consolidate authentic farming practices in the Carpathian Mountains by integrating traditional activities with modern-day food safety measures and economics. The aim is to provide benefits to actors along the entire value chain, linking mountain producers practising time-honoured techniques to the end customer, through a series of carefully planned processing and marketing steps.

In Romania, agriculture remains an important economic and labour-intensive sector, involving 36 percent of the population, and contributing 21 percent of gross domestic product. The Romanian Carpathian Mountains are home to more than 14 million sheep, from which high-quality products are made using traditional techniques. Until recently, however, it was hard to find these products in shops or restaurants, as efficient marketing and distribution networks were lacking.

The traditional livestock system in the Romanian mountains is based on the *stana*, the Romanian term for a sheepfold. During the grazing season (May–October), entire communities send their animals up onto the alpine pastures, where there are mostly no roads, water or electricity. In an effort to modernize the value chain, four Romanian NGOs – the Mountain Farmers' Federation "Dorna," AGROM-RO, ROMONTANA and the Open Fields Foundation – have joined with the Swiss Centre for Mountain Regions to develop the Carpat Sheep project. The initiative set out to strengthen farmers' associations so as to increase their negotiating power, as well as to develop marketing opportunities and create and consolidate branding in order to attract consumer interest in a quality mountain product. In total, six "model" sheepfolds were built in the Eastern Romanian Carpathians, fully equipped and designed to blend traditional high-quality production techniques with European standards of hygiene, traceability and food safety.

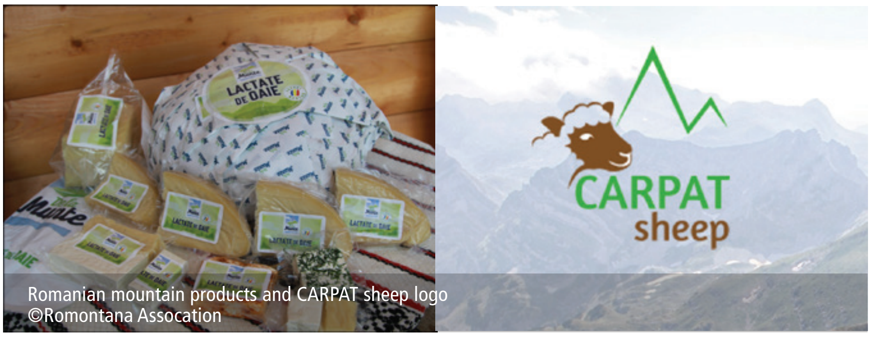
Hut in Romanian Carpathian Mountains (©Romontana Assocation)

A farmer seeding his pasture
©Romontana Assocation

Project activities covered all phases of the value chain, starting with pasture quality and ending with the final product served to the consumer. A first critical step involved improving the quality of the grass eaten by sheep by seeding pastures with indigenous herbs and securing water sources for both the animals and cheese production. Some 636 farmers were trained in pasture management, leading to an improved floral structure for 1 155 ha of pastureland. A further six sheepfolds and six sheep shelters were also built.

Market opportunities were increased by providing technical assistance to meet veterinary requirements, traceability and food safety compliance for three clusters of product types, together with support for marketing and branding. Over a period of two years, the volume of cheese sold increased by 80 percent, while the price of yellow cheese rose by 13 percent and that of ricotta by 21 percent. New marketing channels were explored, such as markets, regional fairs, local shops and bed and breakfasts.

A total of 546 farmers graduated from vocational training courses on the themes of farm management and conditions for subsidies. Exchange visits for 188 people were conducted to the project sites, and study visits were organized for Romanian



Romanian mountain products and CARPAT sheep logo
©Romontana Assocation

producers to see milk processing units in France. In addition, partnership agreements were signed between six local farmer’s associations and local councils, as well as with national/regional authorities.

In parallel, a number of institutional measures have helped to advance the Carpathian sheep-based value chain. In 2017, the “Mountain Product” label was officially introduced in Romania for products from mountain areas. Soon afterwards, the Government of Romania adopted the Mountain Law, which provides farmers with access to finance to build sheepfolds in line with the model developed by the Carpat Sheep project. In the future, the Carpat Sheep team is considering experimenting with further innovations to the six pilot sheepfolds, as well as building capacity for producers and other value chain actors interested in developing the potential of mountain products.

Swiss valley of Valposchiavo
©Valposchiavo Turismo

Smart and organic – A Swiss valley stakes its future on sustainable territorial development

Cassiano Luminati and Diego Rinallo

Smart approaches to territorial development can be applied to rural as well as urban areas. The Swiss valley of Valposchiavo has increased its organic production from 60 percent to more than 90 percent through a territorial branding and smart planning strategy based on participatory governance and cross-sectoral and heritage-sensitive initiatives.

Valposchiavo is an Italian-speaking valley (269.3 sq km, 4 700 inhabitants) in the southern part of the Swiss canton of Grisons. Already in the 1990s, 60 percent of the valley's agricultural land surface was certified as organic, mainly for the production of herbs and milk. At the time, limited cooperation existed among the agricultural production, food processing and tourism sectors, and several traditional crops had disappeared.

Then, in 2002, the local museum acquired Casa Tomé, a fourteenth-century farmhouse that was turned into an experiential showcase of the area's agricultural heritage, including educational visits to nearby fields. The resulting interest in local crops facilitated the development, in 2015, of a local territorial brand, piloted by the tourism management organization Valposchiavo Turismo, in cooperation with local farmers, crafts and trader associations, and with political backing from the Valposchiavo Region. Today, more than 150 products are certified as

100 percent locally produced and made from local ingredients – bearing the 100% Valposchiavo label – or as mostly made with local products, with at least 75 percent of their added value locally generated (*Fait sü in Valposchiavo*). Additionally, 13 restaurants have signed the "100% Valposchiavo Charter," committing to using local products for the preparation of at least three 100 percent local dishes. The initiative has increased local organic production, positioned Valposchiavo as an enogastronomic destination, and created a local market for food ingredients. It has also stimulated innovation and cooperation between farmers and producers. A case in point is a partnership of two restaurants, the Poschiavo Dairy and a local farmer, for the supply of locally produced mozzarella and tomatoes for "100% Valposchiavo" pizza.

At the end of 2017, 14 local farmers and food producers joined with Valposchiavo Turismo to launch the "100% (Bio) Valposchiavo association." By then, more than 90 percent of local agricultural production had turned organic. In 2012, the Valposchiavo Region and the Agricultural Fund Operating Group developed a preliminary Regional Development Project, submitted in 2015 to the Swiss Confederation and approved in 2019. In the 2020–2024 period, the project will finance initiatives to halt the flow of raw materials from leaving the valley, as well as actions to support the few farms not yet converted to organic production, and collective marketing and promotional measures for local products. Total public–private sector investment is estimated at CHF 15.92 million (USD 17.4 million).

Another ongoing project, Valposchiavo Smart Valley Bio, will contribute to the valley's territorial development by safeguarding and valorizing its landscape.

Several restaurants in the Valposchiavo Valley have committed to using local products in their dishes
©Valposchiavo Turismo

Cultural, social, economic and climate shifts are threatening the valley's local identity, memory, values and landscape. To mitigate these risks, the project will co-develop an interactive and updatable hyper-map of the community's and territory's values. The map, based on a participatory process, will identify territorial values and where they feature in the landscape, enabling users to visualize ongoing territorial conflicts and balance cultural, economic and ecological interests.

The project will also train landscape mediators to communicate the landscape's values and beauty, and create new tourist experiences; develop school projects to pass on territorial knowledge and values to future generations; support territorial marketing initiatives based on synergies between farming and tourism; and align current initiatives to long-term strategies to create the basis for Smart Valley Bio certification. The initiative will be coordinated by the Polo Poschiavo, a centre for continued education and support to territorial development projects, with the participation of various local stakeholders in the fields of agriculture, education, culture, tourism and commerce. Its outcomes will lay the foundations for the development of an Alpine Globally Important Agricultural Heritage System (GIAHS).

Both cases highlight the potential for sustainable territorial development through the deployment of well-planned and coordinated initiatives that reinforce each other's impact. Territorial brands can contribute to the restructuring of local agrifood supply chains and accelerate the process. Smart land approaches to sustainable territorial development should be based on cross-sectoral initiatives, education to develop local skills, and participatory governance systems, involving local stakeholders and communities. They should also be future-proof, considering how megatrends might affect ongoing initiatives and preparing for future challenges; and heritage-sensitive, ensuring that the local cultural patrimony is safeguarded and transmitted to the next generation, and that important traditional crops, productive know-how and consumption rituals are not forgotten.

Key challenges include difficulties in uniting actors in a common vision; overcoming the scepticism of risk-adverse community members; sourcing funding and an appropriate "institutional home" for projects to give them stability; and creating a critical mass of initiatives that generate a self-sustaining virtuous circle.

Organic cinnamon cooperative discovers strength in numbers in Viet Nam

Vu Le Y Voan and Pham Tai Thang

Cinnamon growers in Viet Nam's mountainous Yên Bái province have learned that there are advantages to working together. Since 2015, producers in this richly forested area have been helped to organize themselves into groups and cultivate organic cinnamon, earning higher incomes as a result.

Prior to 2015, in the Dao Thin Commune's mixed landscape of natural forest, cinnamon and other trees, cinnamon producers sold their products individually to middlemen, without any market information or negotiating power. Prices were low and unstable, and producers' incomes were badly affected by the high cost of the chemical fertilizer and pesticides that they used.

Helped by the FFF programme, with support from the Viet Nam Farmers' Union (VNFU), the cinnamon growers embarked on a new strategy, based on grouping together and receiving capacity-building in organic farming, improved practices and marketing and business skills.

A first move involved forming four collective cinnamon groups, but the members soon realized that it would make more sense to merge, so that they would now have 39 members and 135 ha of cinnamon. This group worked out a business plan, conducted a market study, looked for potential buyers, and introduced its cinnamon products at agricultural fairs. Members also started learning and applying organic cinnamon practices to improve product quality.

GIAN HÀNG TRƯNG BÀY GIỚI THIỆU SẢN PHẨM
ỢP TÁC XÃ QUẾ HỒI VIỆT NAM
HỢP TÁC XÃ
QUẾ HỒI VIỆT NA
THE TOUCH OF NATURE
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Organic cinnamon co-op at a trade fair
©Organic Cinnamon Cooperative Case of FFF Viet Nam

Through a series of roundtable discussions organized by FFF and attended by producers, local government agencies, central government officials, banks and the private sector, the chief problems facing cinnamon farmer groups were identified and resolved. The local authority approved an organic cinnamon development strategy and supported the group to build nearly 2 km of forest roads. A private sector company active in processing and distribution expressed interest in enhancing the quality of organic cinnamon products to meet export markets.

In 2016, members of the group established a cooperative to expand their organic cinnamon production, processing and business activities, and took out a lease on land for a processing plant. Some members invested their own money in a joint business for organic cinnamon processing, together with the company whose director they had met through the roundtables.

After gradually expanding the area under organic cinnamon production, in 2017 group members launched the Viet Nam cinnamon and star anise cooperative in Dao Thinh, in partnership with the private sector Viet Nam Samex exporting company. The farmers now produced more than 500 ha of organic cinnamon and the local authority allowed the cooperative to lease 9 900 sq m of land to build a factory.

The cooperative currently sells various washed and dried grades of organically certified cinnamon to national buyers and importers from the European Union and Japan. With 23 founding cooperative members, more than 500 associate members are supplying organic cinnamon to the processing factory. Incomes have increased, since the price of organic cinnamon is 30 percent higher than conventional products. The cooperative organizes training and applies an internal control system.

Yên Bái has the advantage of both forest and farms. The FFF has helped forest and farm producers increase solidarity in the communities, helping to link collective groups and cooperatives with local authorities, agencies and departments to solve their problems. In addition, FFF has supported them in finding partners for production and business, especially in the case of the organic cinnamon model in Dao Thinh commune, increasing incomes for Yên Bái farmers and also sustainable forest and farm development.

Giang A Cau,
Chairman of Yên Bái Farmers' Union

Organic cinnamon processing
©Organic Cinnamon Cooperative Case of FFF Viet Nam

Output has increased to 80–100 tonnes per month, with 12 kinds of organic cinnamon products, creating jobs for up to 100 people, the majority of whom are women. More than 600 forest farmers have been trained in organic farming for cinnamon production and that of other crops and trees.

Bolstered by confidence due to the organic farming experience, and with support from the Viet Nam Farmers' Union, two new collective groups have been established to diversify the organic production base. One grows organic herbal plants, while the other plants organic mulberry for silkworm production. Both are now applying Participatory Guarantee Systems to control organic product quality. In an effort to expand organic and agroecology farming in Viet Nam, the FFF is now providing training in organic farming and PGS operation for rice, fruit trees, herbs and Forest Stewardship Council-certified bamboo, linking producers to enterprises and markets to promote sustainable development.

Following discussions facilitated by the FFF, the growers realized that forming a group could help them share market and technical information, aggregate their supply, and hopefully negotiate better prices for their product. This crucial, early trust-building work by the FFF led to the formation of four collective groups, locally called "To Hop Tac."

Duncan Macqueen,
International Institute for
Environment and Development

Collecting wild herbs in the mountains of Armenia
©Darman Tea/Ruzanna Kartashyan

6

Promoting a people-centred approach for the inclusive and sustainable development of mountain agroecosystems

Recognizing the value of connecting culture and agriculture

Barroso Agro-Sylvo-Pastoral System in Portugal
©Municipality of Montalegre)

Clelia Maria Puzzo

There are various ways to turn the potential of mountain agriculture into tangible benefits for farmers' food security, cultural traditions and income, while safeguarding the environment. Actions include product labelling, agritourism experiences, technological innovation and the creation of niche markets, all designed around the uniqueness of mountain agricultural systems and ensuring the conservation of core elements.

One option to enhance recognition and the global value of mountain and other specific agroecosystems is FAO's Globally Important Agricultural Heritage Systems (GIAHS) programme.[5] It includes territories where local communities have successfully conserved agrobiodiversity, landscapes and cultural values for centuries and, in some cases, millennia. The sustainability of these systems is ensured by the strong sociocultural environment created by local communities and by interrelations between culture and farming systems.

Through this programme, FAO highlights the local knowledge that helped to develop ingenious agricultural practices, which have proved to be sustainable over time and hold important lessons that may be used to respond to current global challenges. Examples include modifying the landscape to ensure sustainable natural resource management (soil and water), replacing or mixing specific crops to increase resilience to shocks, shifting to different activities, and changing land uses, depending on the season or fluctuating climatic conditions.

The GIAHS approach relies on the concept of dynamic conservation: recognizing that farming communities and their landscapes cannot be conserved in a static way, and supporting decision-makers in designing actions that encourage rural development strategies based on innovations.

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[5] www.fao.org/giahs/en/

To become part of the GIAHS programme, a site needs to include measures that support adaptation to change and be presented by a national governmental institution, following a multi-stakeholder consultation process. A proposal document is submitted to FAO, describing the site against the five GIAHS selection criteria (FAO, 2017):

- food and livelihood security;
- agrobiodiversity;
- local and traditional knowledge systems;
- culture, values and social organizations; and
- landscape and/or seascape features.

A Dynamic Conservation Action Plan has to be developed, together with the community concerned, and presented to FAO with a list of supporting institutions and actors as part of the applicant's commitment to support local communities and conserve the site. The Scientific Advisory Group analyses proposals received by FAO, determines the compliance of the site with requirements and approves its designation, after conducting a careful scientific analysis and a field visit. The strength of the GIAHS programme lies in its capacity to foster collaboration at national and local level for implementation of the Dynamic Conservation Plan, which begins after a system is internationally recognized. As observed in the designated Agricultural Heritage Systems, activities related to GIAHS recognition promote investments and support to the rural development of these areas, thanks to an increased awareness by local communities and the public.

Sustainable wild plant collection – A driver of rural change in the Armenian mountains

Astghik Sahakyan

Millions of people worldwide live near forests and collect plants and berries to improve their livelihoods. If the collection of wild plants is organically certified, the process does not threaten the ecosystem or harm people's health. With the growth of the organic tea sector in Armenia, many women farmers are now able to improve their livelihoods by becoming involved in collecting wild plants.

Armenia is located at the crossroads between Europe and Asia and is mainly mountainous, with agriculture accounting for 13.7 percent of gross domestic product in 2018 and unemployment (20.5 percent) and high poverty rates (23.5 percent) posing major challenges. In this context, the Government has

Rural women in Armenia are trained in wild plant collection
©Darman Tea/Ruzanna Kartashyan

identified wild plant collection as a promising strategy for poverty reduction and sustainable development. Although data on wild collection practices are inadequate, demand for wild plants and berries has greatly increased due to the promotion of organic agriculture in recent years. Growing numbers of organic tea, jam and juice producers are using wild crops in their production, thereby contributing to sector development. Plants collected in mountainous regions include herbs, berries and wild fruits. Wild plant collection mainly employs women (of 50 years and over) in rural areas and serves as a main source of stable income for them.

Within the framework of the World Bank Group's Armenia Gender project 2017–2020, a study was conducted by the International Center for Agribusiness Research and Education Foundation in collaboration with the International Finance Corporation. Activities undertaken included identifying wild collection practices and the culture and traditions in areas where the practice is popular, evaluating the capacities of women involved in wild plant collection, revealing the skills gap among women, developing a handbook on "Sustainable Wild Collection" and delivering training for rural women. In order to fully understand the scope of wild plant collection, interviews were conducted with 18 women farmers/collectors, four middlemen, nine processors and three retailers. The initiative also involved meetings with state officials, sector experts and Armenia's organic certification body. This was to understand state regulations covering the agroecological system and the organic agriculture standards covering wild plant collection.

Wild plants are collected and sorted
©Darman Tea/Ruzanna Kartashyan

The study revealed that working with organic producers offers several advantages:

- **Enhanced knowledge of sustainable wild collection practices:** Prior to the collection period, organic producers organize training for women collectors where these topics are presented: What can be harvested (are there endangered species that are prohibited for collection)? How can these be harvested without damaging the environment and the health of living organisms? What post-harvest activities are allowed under organic standards?

- **Women's empowerment:** For retired women, finding a new source of income and improving the quality of life of family members was a key takeaway from interviews. Women collectors have developed leadership skills and became the contact point between producers/processors and other women collectors, often motivating other women in the village to join their teams.

- **Enhanced biodiversity:** In collaboration with women collectors, organic tea producers work to explore regional biodiversity, conserving natural habitats through sustainable activities and raising awareness about ecological systems among different stakeholders. Fewer than 100 types of plant are currently being used and organic producers are constantly searching for new plants growing in mountainous regions, identifying their useful features and their effective and sustainable use.

Training materials for the project were developed in collaboration with agroecologists and cover a wide range of topics, including plants common to the mountainous regions of Armenia and the environmentally friendly collection and marketing of produce. The study helped researchers to draw attention to the fact that some plant species are already endangered, which led to the development of a separate training module on this topic.

The final outcome of the project was training for rural women in sustainable wild plant collection and the provision of handbooks (available online in Armenian). A total of 20 women, including elderly and young women, participated in the training, which was delivered by other women. The training was interactive, allowing women farmers to share the challenges they face during collection, clarify the requirements set by organic producers, and build connections with producers and NGO representatives.

Women collecting honey from their melipona bees
©Slow Food

Stingless bee honey for Bolivian ecosystem conservation

Chiara Davico

Ask what comes to mind when people think of bees, and inevitably the answer will be honey or stings. But few are familiar with native stingless bees, raised by indigenous peoples for generations. In the Plurinational State of Bolivia, women from the highlands of Chaco de Chuquisaca are breeding melipona bees for their liquid and bittersweet honey, protecting and conserving biodiversity and ecosystems in the process.

In the Plurinational State of Bolivia, different species of native stingless bees are found in the eastern tropics and in Chaco de Chuquisaca, Santa Cruz and Tarija. The area is rich in biodiversity and forestry resources, and a large number of native stingless bees are responsible for pollination of annual and perennial crops, as well as many other species growing in the forest.

Recently, in Chaco de Chuquisaca, beekeeping has become an important activity due to advances in family farming management. In 2015, five women's associations, based in an area with altitudes of between 1 100 and 3 300 m, began working in meliponiculture – the term given to the cultivation of stingless bees on a commercial scale for honey production or pollination. The focus is on conserving the environment and biodiversity and generating an additional source of income.

Women have sole responsibility for maintenance of these fragile bees, and nearly 200 women with basic technical knowledge are now involved in the management and production of melipona honey. They face challenges that include lack of management skills, lack of control and prevention of pests, lack of complementary food in winter, inadequate breeding boxes, weak hives, use of inappropriate honey harvesting techniques, and storage in unsuitable containers, leading to excessive air exposure, which shortens the honey's shelf-life.

To assist these women and improve the stingless bee product value chain, in 2018 the MP joined with Slow Food to organize training sessions for 160 women in sustainable agricultural practices for beekeeping and business management. The training was conducted in coordination with PROMIEL, the Bolivian public enterprise tasked with developing the national apiculture sector.

As a result of technical assistance, the women beekeepers have been able to develop sound management practices for the native bees. In addition, 25 local women facilitators attended the training, with a focus on environmental care and biodiversity, responsible capture, hive division, feeding and harvesting techniques. The facilitators are now training producers in their community, to disseminate the knowledge.

In addition, the training led to implementation of a regulation among women beekeepers, regarding care of the forest as a main supplier of honey plants and native bee habitats. Many women strongly believe that meliponiculture should not only pursue economic ends, but it should also contribute to the conservation of the local environment and biodiversity.

The appointment of women facilitators has played a crucial role in empowering other women producers, generating a new dynamic that is leading to greater equality in communities and the active participation of women and young people in the melipona honey value chain. In addition, meliponiculture is extremely important for the sustainable management of the territory and the protection of biodiversity. These two factors have led women to ask local governments to work together on a reforestation plan.

Melipona honey is an increasingly rare commodity. Deforestation and the introduction of the more productive European honeybee have affected the distribution of the 350 known stingless bee species. There is therefore an urgent need for greater knowledge about the different species of melipona bees, as well as their favourite flowers and their behaviour. To this end, a census was conducted of all the communities located in the Monteagudo and Villa Vaca Guzmán Municipalities and the Iñao National Park and Integrated Management Natural Area. Based on the information analysed so far, the highest diversity of species is observed inside the Serranía del Iñao Protected Area. In other areas, dense human populations and intensive agriculture using agrochemicals have led to changes in native vegetation and a dramatic reduction in vegetation mass. Primary and secondary forest area has declined, soil has been strongly modified and water has been contaminated. All these disturbances have led to emissions of penetrating odours, which are believed to be partly responsible for the disappearance of meliponas.

In an effort to add value to melipona honey, the MPP initiative has assigned the product its narrative label, which tells consumers the story of the product's origin, processing methods and organoleptic and nutritional characteristics.

As next steps, the producers plan to:

- promote a PGS, which is expected to generate important advantages for the valorization of melipona honey, highlighting its qualities, properties and origin and certifying them organically for the domestic market;

- diversify the products generated by the hive, for consumption and promotion in the local market; and

- promote ongoing research on bee varieties and validation and dissemination of climate change adaptation measures.

Keeping melipona bees in the highlands of Chaco de Chuquisaca, Plurinational State of Bolivia
©Slow Food

Biological and anti-erosion measures to improve livelihoods in Moroccan watersheds

Malika Chkirni

Soil is the principal resource for the survival of all species of life, but it can become degraded through water and wind erosion. To address soil erosion in Morocco's Midelt area and the Oued Outat watershed, biological and mechanical measures have been implemented, with the added benefit of improving croplands downstream.

Natural resources – vegetation, land and water – are under growing pressure in the Midelt area and the Oued Outat watershed, in the high plains of central Morocco. The over-exploitation of indigenous and introduced species, coupled with the intensification of activities related to extensive livestock farming in forests and the cultivation of fragile land have created an unsustainable situation.

A farmer and her goats in Morocco
©Chkirni Malika

Goats and sheep in Morocco
©Chkirni Malika

This area is home to about 23 600 people, almost all of them dependent on land use. They are not only the cause of many environmental and poverty problems, but also the key to solving them. In this context, there is a conflict between the designation of protected areas and the continuation or introduction of agricultural land use, for example, through the application of environmentally compatible forms of conservation, such as agroforestry. Given that poverty-oriented rural development based on long-term resource protection is indispensable for this area, any measures taken must be in keeping with the special living conditions, interests and knowledge of local farmers.

Soil, a limited and non-renewable resource, is currently being lost at the rate of about 3 tonnes/ha annually in this upland area. The Participatory and Integrated Watershed Management Project for Erosion Control[6] has implemented a range of methods and approaches to prevent soil erosion by water and wind. Activities of the project have included:

- physiographic and socio-economic indicators from the diagnostic studies;
- discussions and interaction of various workshops (20 training workshops have been organized, with 600 beneficiaries, 25 percent of them women);
- five trips organized for information exchange;
- meetings and contacts with partners; and
- development of co-management plans.

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[6] Projet de Gestion Participative et Intégrée des Bassins Versants pour la Lutte contre l'Erosion (Kingdom of Morocco, FAO and Switzerland)

Four specific objectives and methods have been identified for the management plans, namely:

- reduction of the effects of hydric and torrential erosion (flooding) through the reconstitution of native vegetation, both upstream and downstream of the watershed. This has involved the installation of a mechanical and biological anti-erosion infrastructure at the level of the ravines and slopes;
- adoption of silvopastoral management specific to the physiographic and socio-economic conditions of the area and organization of nomadic and sedentary herders into associations;
- improvement of agroforestry techniques and pipelines through the rehabilitation of irrigation water diversion canals and installation of new innovative systems for enhancing the value of agricultural land; and
- popularization of appropriate cultural techniques and diversification of tree crops.

As part of the strategy, various technologies have been implemented, such as forest plantations, mechanical anti-erosion correction of gullies (gabion thresholds), biological anti-erosion gully treatment, mechanical and biological development of banks, diversification of fruit trees and the introduction of fruit species adapted to the ecological conditions of the environment. Farmers have been trained to

Beekeepers working in Midelt area, Morocco
©Chkirni Malika

combine mechanical and biological treatments. The hydro-agricultural network has been monitored, leading to a slowing of runoff along the watershed drainage system, which in turn has resulted in reduced soil stripping and better maintenance of topsoil.

The condition of croplands downstream of the watershed has improved and the lifespan of hydro-agricultural structures has increased. More than 1 000 farmers have benefited from the project, and display a strong sense of commitment and motivation. The Government of Morocco is continuing to evaluate and implement the co-management plans by outsourcing the experience to other watersheds at communal and regional levels and moving ahead with reforestation activities.

Community-led conservation in Peru's Potato Park

Nisreen Abo-Sido

The Parque de la Papa/Potato Park in Cusco Valley, Peru presents a model for community-led conservation using traditional and agroecological approaches. The Amaru, Chawaytire, Cuyo Grande, Pampallaqta, Paru-Paru and Sacaca – indigenous Andean peoples – live together and collaboratively manage the Park, with the goals of supporting their livelihoods while conserving biodiversity, landscapes and culture.

The Parque de la Papa approach is built on the *ayllu* system, which is a traditional Andean model of community organization that promotes *sumak kawsay* – or well-being – by fostering harmony among people, domesticated species, and sacred or wild elements. Though frequently studied as a political and socio-economic structure, the *ayllu* is also an ecological framework, in which promoting reciprocity between the various communities creates an active and holistic landscape management system.

Among the many agroecological techniques practised by the people of the Park, two that exemplify how such practices arise from the interaction of the *ayllu* system with land management in the Peruvian Andes include seed-saving approaches and farming along mountain gradients.

Indigenous Andean peoples collaboratively manage the Potato Park, Peru
©Nisreen Abo-Sido

EL SISTEMA AYLLU

The Potato Park is built on a traditional Andean model of community organization called *ayllu*
©Nisreen Abo-Sido

Led by local technicians from each of the indigenous groups, the people at the Park practice *in situ* seed conservation that includes conserving crop wild varieties. The benefits of these techniques are many. Firstly, in addition to saving seeds in *ex situ* seed banks, it is advantageous to save seeds *in situ*, so that they are more continuously shaped by the dynamic relationships between the abiotic and biotic elements in the changing environment, encouraging the reciprocity required by *ayllu* systems. *In situ* seed saving continues to allow natural genetic exchange between landraces and their wild relatives. This agroecological approach fosters biodiversity, while increasing species' adaptive capacities and promoting resilience.

The development of microclimates along an altitudinal gradient is characteristic of mountain environments, and can manifest itself in drastic changes in niches along slopes. Climate change could alter these niches, disrupting ranges at which species may thrive, consequently reducing biodiversity and threatening food systems and livelihoods. Communities at the Park collaborate within the *ayllu* system to make decisions about landscape management on the repatriation of potato varieties. They share traditional knowledge of these microclimates and their potential to shift in efforts to maximize productivity, support food systems and improve livelihoods. For example, communities will grow crops in the most suitable conditions along these microclimates, and then trade the products between the upper, middle and lower altitudes. Moreover, efforts have been made to plant more cold-adaptive potato varieties at higher altitudes to conserve the varieties under the effects of climate change. Indigenous knowledge and communal collaboration are integral to the agroecological management of these zones, as community members make decisions about what to grow and where, in ways that conserve biodiversity and support livelihoods.

In promoting harmony among all the *ayllu*, the system encompasses FAO's 10 Elements of Agroecology, as it expands the definition of agroecology to include the importance of spiritual and religious beliefs in influencing human–nature interactions. Technicians at the Potato Park emphasize that they feel a responsibility to conserve and protect potato biodiversity, not just for their communities, and not just for Peru, but for the entire world. For this reason, they regularly participate in and facilitate knowledge exchange, nationally and internationally, with visiting farmers and indigenous communities, as well as with students and scientists. In one example, the Park technicians led workshops on the *ayllu* system, protecting native species, saving seeds, managing cooperatives, and various other topics to a visiting group of indigenous peoples from Lake Titicaca, Peru, who were interested in establishing a site similar to the Potato Park – one that would improve local livelihoods, while conserving biodiversity and promoting knowledge exchange.

In another example, the Park technicians described their engagement with a long-term study on the effects of climate change on potato growth and the potential for potato adaptability in the region. They are performing the study in partnership with researchers at the International Potato Center (CIP) and describe the synergy resulting from the combination of traditional knowledge and landscapes provided by the communities and the technical knowledge and resources provided by CIP. This form of knowledge exchange promotes resilience and bridges gaps in understanding and approaching problems within food systems and environmental conservation, ultimately leading to greater sustainable development and food sovereignty. Such a system can only work effectively if communities are empowered to lead with autonomy. Recognizing the value of traditional, indigenous, and cultural knowledge must be central to any attempt to uplift marginalized communities and promote community-led and rights-based approaches to conservation and food security.

Tradition lives on in Portugal's Barroso Agro-Sylvo-Pastoral System

António M. Machado

In 2018, the Barroso Agro-Sylvo-Pastoral System was among the first European sites to be listed as a GIAHS. Located in the Alto Tâmega region of northern Portugal, this is a natural landscape that includes the Peneda-Gerês National Park, where the existing agrarian model has remained to the present day, based on a rural subsistence economy, typical of mountain regions.

The Barroso agrarian system is strongly influenced by the soil and climate conditions, with a predominance of smallholdings and pastoral cattle, sheep and goat farming, as well as pig-rearing, which makes a significant contribution to household economies and plays an important social role.

The system is a landscape mosaic, in which ancient pastures (marshes and common land), farming areas (rye and potato fields and vegetable gardens), thickets and forests are interwoven, and where the animals (mainly cattle) are used to transport materials among the system's components.

Cow grazing in Barroso Agro-Sylvo-Pastoral System
©Municipality of Montalegre

This is a rural subsistence economy, with little input or surplus produce. Farms are small (less than 1 ha) and usually managed in a collective way. Isolation has maintained ancient and archaic lifestyles, based on a strong sense of community in each village, where self-sufficiency and solidarity among residents are marked cultural features.

The geographical location, orography, soils, climate and human interactions have led to the development of important plant and animal communities in the area, including endangered species and populations. As a result, parts of this territory are included in Portugal's only national park, Peneda-Gerês National Park, the Gerês-Xurés Cross-Border Biosphere Reserve, and the Natura 2000 Network.

From a cultural perspective, the 14 255 inhabitants of Barroso have developed and maintained forms of social organization, practices and rituals which make them stand out from most populations in the country, in terms of habits, language and values. These have been largely shaped by the conditions and geographical isolation, as well as by the area's limited natural resources, which have led people to develop methods of using them that are consistent with sustainability.

External threats to the region mainly revolve around Portugal's current economic situation, which acts as a strong disincentive to investment (increased tax burden, low employment). The bureaucratic and organizational requirements for accessing financial support are also ill-suited to the size and capacity of local businesses, which are, in the main, run by family farmers or food processors.

The Barroso Agro-Sylvo-Pastoral System was among the first European sites to be listed as a GIAHS
©Municipality of Montalegre

For the dynamic maintenance of Barroso's agrarian system to continue and develop in the coming decades, it will be important to encourage certification and differentiation systems, which demonstrate the quality and diversity of products to consumers. These can help to strengthen consumer confidence, while conveying a message associated with cultural values specific to the region, as well as ensuring respect for the values and demands of the consumers themselves, such as environmental protection and animal welfare.

A range of activities has been planned under various projects and funds, with the aim of valorizing and promoting the territory and helping people to understand the traditions and culture of Barroso. These include building an information centre and developing agritourism initiatives, as well as efforts to shorten the food supply chain between local producers and consumers.

One of the challenges for this region is its ageing population and low level of education, which could lead to the loss of valuable traditional knowledge. For this reason, there are plans to make greater efforts to attract younger people into the agriculture sector, not just as producers *per se,* but also as figures whose greater innovative and entrepreneurial potential can ensure a sustainable future for this ancient mountain landscape.

Agroecological farming in Falaba, Sierra Leone
©GEF-SGP/Abdul R. Sannoh

Agroecology farming for sustainable community land-use management in Sierra Leone

Abdul Rahman Sannoh

A pilot project based on agroecology principles is helping to restore severely degraded land in the mountainous Falaba District of northern Sierra Leone. It has introduced agropastoral ranching and organic vegetable farming, as well as reforesting strategic areas of a woodland savannah plateau, increasing revenues for the communities involved and laying the foundations for a more sustainable future.

Rapid land degradation, caused by slash-and-burn farming, open livestock grazing and the exporting of threatened species of tropical hardwood, is causing serious damage to the landscape and livelihoods of communities in an upland area of Sierra Leone. The resulting deforestation, fluctuating rainfall and reduced soil fertility have gone hand in hand with a steady decline in agricultural productivity, and a widespread increase in hunger and malnutrition. Located in the country's northeastern interior plateau and dotted with hills and mountains, Falaba District is one of the poorest areas of Sierra Leone, with an average annual household income of less than USD 500.

In 2018, the Tinkifirah Descendants Association received USD 30 000 from the GEF Small Grants Programme to implement a 12-month pilot project for four self-help groups in four communities. More than 150 farmers were targeted as beneficiaries, 60 percent of them women and most identified as vulnerable, with limited access to income, good shelter and adequate balanced food.

The project trained small-scale producers – who are predominantly subsistence farmers from the Kuranko ethnic group – in forestry and sustainable organic farming technologies, including setting up nurseries, composting and traditional pest control. Basic vegetable farming tools, including hoes, machetes, rakes and watering cans, were given to each group, as well as seeds to grow watermelon, peppers, onions and tomatoes. Each community contributed land for vegetable cultivation, the sale of which generated income for many women and young people who had previously been employed in the timber trade.

Farmers display their onion harvest, Sierra Leone
©GEF-SGP/Abdul R. Sannoh

To address the problem of damage caused by open grazing, a 160 ha cattle ranch was created and fenced off using barbed wire and more than 8 000 tree logs as poles, which will eventually regenerate and grow into taller trees. Two ranch caretakers were trained in improved animal husbandry and ranch techniques, including vaccination, stalk-feeding, feed grass and fodder plant cultivation. The farmers bought 22 cattle, using savings from their vegetables, and placed them in the community ranch. Fallen leaves, crop plant residue and livestock droppings are composted into organic fertilizer to improve agricultural productivity. Strategic degraded areas measuring 226 ha have been reforested, through the planting of 18 000 indigenous trees.

Demonstrating the core principles of agroecology farming through the introduction of sustainable vegetable production, livestock rearing and tree planting, the project has helped to diversify farm income activities and bolster food production and nutrition intakes, in so doing building resistance to poverty and hunger and resilience against climate change.

The immediate results of the project include an estimated 30 000 ha of community land freed from livestock overgrazing, thereby allowing the regeneration of natural vegetation. Some 760 household members have benefited from sustainable incomes generated by vegetable production and cattle rearing. Overall, the project has contributed to improved food security and nutrition for more than 5 000 people in mountain communities.

Challenges included the difficulty of aligning the individual interests of stakeholders with the common goal of sustainable community land-use management, as well as sourcing a sustainable supply of vegetable farm inputs.

Planned next steps will involve reinforcing the fencing of the grazing area, expanding reforestation efforts to water catchment areas and upscaling the vegetable farming to other communities. The long-term aim is to transform the initiative into a profit-making social enterprise that is commercially viable. Already, the model has attracted interest as a sustainable approach to alternative income generation for poor rural mountain communities.

For the Chagga community living on the slopes of Mount Kilimanjaro, *kihamba* (plots of land with a home and vegetable garden) are an essential and traditional part of young people's lives
©FAO/Felipe Rodriguez

Conserving an ancient agroforestry system on the slopes of Mt. Kilimanjaro, United Republic of Tanzania

Firmat Martin Banzi

The time-honoured Tanzanian kihamba *(Chagga home garden) agroforestry system has been recognized as one of the country's best examples of resilient upland farming. Its dynamic conservation through targeted measures on the ground, combined with effective policy support, is helping to ensure food security and livelihood sustenance, as well as sustainable environmental management and the continuity of its living agricultural heritage.*

At the foot of Mount Kilimanjaro in the United Republic of Tanzania's rural Moshi district, Uru-Simbwejuu village has been selected as a GIAHS site by the FAO GIAHS Secretariat. The village has been chosen due to its reliance on the *kihamba* – or *Chagga* home garden – agroforestry system, which is thought to have first evolved during the twelfth century.

The *Chagga* home garden system is characterized by a unique multilayered vegetation-based land-use approach. Typically, the garden is composed of four vegetation layers, where the uppermost is formed by sparsely spaced trees that provide shade, medicine, fodder, fruits, fuelwood and, for some species, timber. Under this layer, more than 15 varieties of bananas are grown. Below there are coffee shrubs and under these, shade crops such as yams, taro and vegetables are cultivated, including climbers such as passion fruit and oyster nuts. This multi-layered system maximizes the use of limited land.

Mainly found on the southern and eastern slopes of Mt. Kilimanjaro, the *kihamba* agroforestry system covers an estimated area of 120 000 ha. It is central to the identity and culture of the Chagga tribe. People are born, grow up, marry and are buried on their *kihamba*.

As part of efforts by the German Technical Cooperation and partners to establish GIAHS sites in Kenya and the United Republic of Tanzania, the *kihamba* was identified as deserving support in line with GIAHS criteria and objectives. Through observations and discussions with the village community, the following challenges were pinpointed:

- low productivity of *kihamba* arising from low yields of coffee and associated crops;
- unreliable market access and associated decline in coffee prices, leading to reduced income;
- high cost of pesticides used to control coffee pests and diseases;
- inadequate water for irrigation during the dry season. Climate change has resulted in low and erratic rainfall over the past two to three decades; and
- population increase, leading to fragmentation of *kihamba* (less than 0.2 ha).

Due to these difficulties, some farmers have abandoned their traditional farming system or shifted to annual crops. In order to secure the sustainable cultural management of the area, as well as the heritage and environmental benefits it provides, the GIAHS project was introduced in 2010. The project aimed to help the community to conserve its natural resource base, together with land and crop management practices and knowledge systems, while adapting the system to contemporary challenges. A critical part of the approach involved improving the food security and well-being of the community and transforming the considerable benefits of the *kihamba* agroforestry system into a sustainable form of livelihood generation, compatible with the landscape and its rich cultural heritage.

On-site activities aside, the project also deployed a number of policy measures aimed at ensuring recognition and protection for the area, and the heritage practices and resources it represents, as well as broader awareness-raising among policy makers and other stakeholders of the values of Tanzania's heritage agricultural systems.

A participatory action plan was developed, together with the community. The main activities were improved management of *kihamba* coffee and other crops, including an efficient irrigation system, and the development of a long-term management plan for the area through community agreements. Alternative cash crops such as vanilla and watercress were introduced, together with appropriate marketing strategies. Priority was given to the restoration of traditional values and knowledge systems linked with *kihamba* and their transmission to generations.

Based on improved coffee management, the community decided to practice organic farming, which is relatively low-cost and has an assured market. To this end, the project linked the farmers to the Kilimanjaro Native Cooperative Union, and the entire village community received training in integrated pest management and organic production ethics. Members agreed to gradually replace the old coffee trees, and the project facilitated the setting up of a coffee seedling nursery to enable farmers to revive abandoned farms, replant new coffee trees and increase productivity.

In 2017, community members were certified as organic farmers and linked to the organic coffee market. A local coffee marketing point was set up in the village where inspection, grading, bagging and storage are done to facilitate coffee marketing.

With an eye on the future, a model *kihamba* has been selected to serve as a learning ground for people wishing to know about the system, and to ensure sustainability for the initiative. Although challenges remain in developing the *kihamba* system, GIAHS support has underscored the fact that this ancient form of land use is one that is well worth preserving.

Organic vegetable production promotes sustainable livelihoods for Thai hill tribes

Pedcharada Yusuk, Siriporn Thipan and Bunpracha Thongchot

More than ten ethnic hill tribes in the northern Thai mountains have transformed their subsistence agriculture to organic farming through an ongoing development-oriented research programme. The organic farming has not only enhanced household food security and decent employment in the area, but has also improved an upstream watershed, with long-term benefits for the mountain ecosystem and downstream communities.

In the six mountainous provinces of Thailand, home to more than ten indigenous hill tribes, most farmers have traditionally lived off the subsistence economy, based on the shifting cultivation of upland rice. A project launched back in 1968, and continuing to this day, targets integrated mountain livelihood development through research and development to improve the productivity of 349 alternative food crops and livestock. The Royal Project promotes environmentally friendly farming that includes good agricultural practices, biological extract application and organic standards, while protecting the upstream origin of water resources that supply the downstream population. In 2018, farmers produced 1 847 tonnes of organic vegetables for a value of approximately USD 1.9 million. The organic produce was largely sold to the domestic market.

From 2003 to 2018, the number of farmers involved in the programme grew more than tenfold. Thanks to the programme the production of organic vegetables has also grown: in 2003, there were 50 ha of farms under organic production with an output of 120 tonnes of produce, and in 2018 these increased to 320 ha and 1.8 thousand tonnes of production.

Focus group for product specification
©Pedcharada Yusuk, HRDI, Thailand

Farmer harvesting organic pak-choi
©Pedcharada Yusuk, HRDI, Thailand

The initiative has involved improving soil health in upstream mountains, including through the analysis of soil properties, construction of terraces and addition of green manure to farmland. Thai mountains are rich in biodiversity and local plant species that can be used for organic compost and biopesticides, and more than 20 innovative bioagents have been developed from microorganisms for pest and disease control in the highlands.

Starting in 2003–2004, farmers, researchers and extension staff have been involved in on-site participatory research and training to understand more about Thailand's organic standards. As a result, growing numbers of farmers from indigenous hill tribes have received organic certification for their vegetables.

Organic vegetable production in the Thai mountains involves engagement with farmers, researchers, field officers and the private sector. Many farmers have organized themselves into collective groups to manage agricultural inputs that include organic compost and biological extract, and to plan production in response to market demand. Meanwhile, an in-house research team is constantly developing more effective organic farming techniques that are applicable for mountain ecosystems. Field officers closely support the farmers in the transformation process and a marketing team explores commercial opportunities.

Organic vegetables have improved both the incomes and food security of hill tribe farmers and their families. One study showed that 52.3 percent of farmers who transitioned from conventional to organic production had increased incomes due to the higher prices fetched for organic vegetables and short-growth crops, which can produce more than conventional ones. Most farmers found that organic production costs were lower than conventional farm costs, since there is no need to buy chemicals and labour is exchanged within the group. In addition, 93 percent of farmers were able to pay off debts and improve their well-being. An added but important benefit is that organic production supports the upstream ecosystem, which is responsible for supplying water to the rest of the nation. Furthermore, Thai consumers are now able to buy and eat safe, home-grown organic products, rather than importing lower quality ones.

Climate change threatens to damage organic vegetable production in the Thai mountains, with rising temperatures and drought likely to cause a fluctuation in quality. To address this challenge, researchers are working with pioneer farmers to develop and test improved organic seed and alternative varieties. This should ensure that organic vegetable production remains a viable option for hill tribe communities well into the future.

Smart Valley Val Poschiavo Switzerland
©Valposchiavo Turismo

7

Opportunities for mountain agriculture

High agrobiodiversity and mountain speciality products

Mountain farming systems host substantial agrogenetic diversity, containing a wide variety of locally adapted crops and livestock, and have the opportunity to produce local nutritious and diversified foods. The wide-ranging diversity found in mountains may include crop wild relatives and neglected plant and livestock species and varieties.

Mountain products satisfy many of the demands of today's discerning consumers, who are often looking for healthy, organic and authentic products that tell the story of the communities behind them. A survey conducted by the Mountain Partnership Secretariat in 2015 in nine countries confirmed that mountain products were perceived as niche products that are healthy and of high value. Mountain products such as spices, teas, grains and cheeses are often produced on a small scale due to the limited resources available in high altitudes and the small size of plots and rural communities, compared with lowland environments. The high value of these products compensates for their small volume, and increasing numbers of consumers are willing to pay a premium for them.

Building the capacity of mountain producers is therefore essential, in order to ensure a steady flow of quality mountain speciality products, both for new markets and for tourists.

Traditional breeds and varieties

Indigenous peoples and family farmers in mountain areas often have a broad knowledge of their intricate and complex local ecological systems, accumulated over generations. Farmers know that biological diversity is crucial for their own resilience, generating ecological services and conserving the resource base and foods on which they depend. In many cases, it is women who hold the traditional knowledge, and they play a critical role in the sustainable use and conservation of biodiversity. Traditional varieties are a source of nutritious food and are often disease-resistant and adapted to local climatic conditions, as repositories of an incredible amount of genetic diversity. They may also have characteristics that can be valuable for further adaptation to climate change, such as a native potato variety with a high tolerance to frost. The promotion of traditional varieties has the potential to improve the livelihoods of local communities by enabling them to sell high-quality products in urban markets, generating an additional source of income.

Unique agroclimatic conditions in mountains offer a comparative advantage for a wide range of fruits, nuts, vegetables, livestock and by-products, as well as for other high-value products, and, according to FAO (2018a; 2019b), many of them qualify as Future Smart Foods (FSF). These are often neglected and underutilized species (NUS) that are nutrition-dense (enhance nutrition), climate-resilient (e.g. require low inputs, promote climate change resilience, are environmentally friendly by reducing runoff and erosion, are economically viable, generate income and reduce female drudgery), and are locally available or adaptable (FAO, 2018b; FAO 2019b). In Asia, for example, countries have identified various crops cultivated in mountain areas as FSF, such as pulses, cowpea, taro, millet, drumstick, quinoa, buckwheat and moringa. These are key to agricultural diversification and play a significant role in narrowing and closing the production and nutritional gap.

Labelling

The use of labels to communicate information about products is essential. The label should make as much information as possible available to consumers about every aspect and step of the production and processing phases, since transparency builds trust. Consumers want to know how things are made, and this can build confidence in the product and the brand. Although consumers increasingly have access to organic/natural products, mountain products remain particularly attractive due to their unique characteristics and their value as clean, pure and healthy goods. This perception should be used as an advantage. The marketing of mountain products should not just focus on the commodities, but should tell the story behind the producers.

Criteria such as taste, cleanliness, traditional expertise, authenticity, cultural heritage and specificity should be emphasized through a marketing strategy. Given the usual premium on the price of such niche products compared with industrially produced versions, the target buyers need to be made aware of the added value (in terms of healthy food, unique taste, etc.). It is crucial to communicate and monitor these benefits clearly whenever possible, in order to justify the premium price.

The promotion of mountain food products and territorial services, through differentiation mechanisms such as quality labels, narrative labels, appellations of origin and protected geographical indications, can provide a tool for farmers and territories to achieve better recognition. To this end, it will be important to share experiences and explore the need for and feasibility of developing a common reference framework, with common criteria and indicators, such as the Forum Origin, Diversity and Territories platform.

Added value

A more specific value chain approach should be tailored to each single mountain product and for each single country and region, considering the major challenges of accessibility, scale and market. Only sustainably managed value chains of this type have long-term and self-sustaining potential, and can show the comparative advantage that mountain products have over lowland and industrial production.

Adding value is not only a matter of processing or packaging; it also involves highlighting ecological, nutritional, cultural and economic values. Value can be created by adopting and processing traditional varieties. Adopting agroecological practices on a farm can enhance ecological, health and social values through better water and soil conservation practices, as well as improved and increased biodiversity, a return of wildlife, and a healthy ecology and living environment for the producers through cleaner and safer working conditions. For that reason, in addition to achieving a premium price, highlighting the full economic value of ecosystems and biodiversity to those who benefit from them can help to encourage investment in their protection and enhancement. Payments for ecosystem services promote sustainable development and the conservation of ecosystem services, generate income in rural areas, and improve food security (FAO, 2012).

The Mountain Partnership Products initiative

The Mountain Partnership Products (MPP) initiative is a certification and labelling scheme based on environmentally and ethically sound value chains that promotes short, domestic value chains while ensuring transparency and trust between producers and consumers, fair compensation for the primary producers, conservation of agrobiodiversity and preservation of ancient techniques.

Developed by the Mountain Partnership Secretariat with Slow Food in 2016, the MPP "narrative" label tells the story of the product: its origins and cultivation, its processing and preservation methods, its nutritional value, and its role in local cultures. It aims to create an emotional link between the producer and the consumer by sharing the story behind each product. Consumers often cannot easily distinguish mountain products from others when displayed in the marketplace. The MPP label aims to communicate the values of mountain products, enabling consumers to make a more informed purchase and the producers to sell at a premium price.

Currently, the initiative operates in eight countries and includes 20 products. Goods marketed under the MPP label include stingless bee honey from the Bolivian Andes and pink and purple rice cultivated by farmers in India's Himalayas, as well as tea, coffee, pulses and textiles. So far, around 10 000 smallholder mountain farmers, grouped as local producers' associations, grassroot foundations and eco-social companies – 60 percent of whose members are women – have been supported by the MPP scheme. The adoption of the MPP label increased the market request of all products and allowed producers to increase output by up to 40 percent, sales by up to 49 percent, and/or the selling price by up to 25 percent.

Mountain agriculture has a comparative advantage for the production of safe and organic products and the MPP initiative supports its partners in establishing quality assurance systems for these. The Mountain Participatory Guarantee System certifies that MPP are ethical, fair and organic and has created the first-ever international network of mountain-specific PGS. The first regional training initiative in Latin America was held in November 2019 and more training sessions involving all MPP initiative partners committed to the Ranikhet Declaration are planned for the future.

Mountain Partnership Product
Himali Black Lentils
Goljung, Rasuwa
Nepal
A Mountain Partnership and Slow Food initiative

Mountain Partnership Products Initiative
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Diversification of products is important for value-adding activities. Mountain products should leave the farm or producers' organization only after being processed insofar as possible on-site, so as to ensure that producers receive an equitable share and are not exploited by middlemen. Creating a detailed label and/or a basket of products can also add value to a product. A basket approach considers the close link between livelihoods and the environment in mountain areas, and calls for an integrated system of production that takes a holistic perspective rather than a focus on individual subsectors. By promoting a set of high-value products and services produced by mountain peoples, the total production system can be intensified, and at the same time the risk of degrading natural resources or food security can be reduced. The production and commercialization of a basket of mountain products can offer a good opportunity to diversify local economies. Since livestock-keeping plays a pivotal role in the lives of many mountain farmers, the diversification of products in livestock-based production systems may include dairy products such as yogurt and cheese produced, as well valuable by-products such as wool (FAO, 2019b), all of which can lead to increased incomes for farmers. Value-adding activities may also include the introduction of simple techniques such as solar drying of fruits and vegetables, which helps to extend the storage life of fresh products.

Sustainable tourism: agritourism, ecotourism and community-based tourism

Tourism is one of the fastest growing sectors in mountain regions, which currently attract 15–20 percent of global tourism (UNEP, 2007; UNWTO, 2018). Tourism has become an important economic resource for mountain areas, bringing new jobs and incomes, and supporting traditional systems that would otherwise face serious economic difficulties. Mountain areas have a comparative advantage, as they often have diverse landscapes and scenery (Debarbieux *et al.*, 2014). According to the United Nations Environment Programme (UNEP) and the World Tourism Organization (UNWTO) (2005), "Making tourism more sustainable is not just about controlling and managing the negative impacts of the industry. Tourism is in a very special position to benefit local communities, economically and socially, and to raise awareness and support for conservation of the environment." Many developing countries have recognized the potential of their natural resources for the development of tourism, maintaining traditional agriculture systems, such as terraces, to improve incomes and attract ecotourism. Yet the sustainability of this kind of tourism in a mountain setting depends on keeping the fragile mountain environment and landscapes intact, while bearing in mind that these environments can be severely affected by ecological changes such as global warming and pandemics (Yanes *et al.*, 2019; UNWTO 2018).

Mountain tourism can only be sustainable if local communities and other stakeholders are willing and able to protect both natural and cultural resources and receive economic benefits. Concepts such as community participation, empowerment, transparency, fairness, equity and doing-no-harm have led to the creation of different types of tourism, such as agritourism, ecotourism and community-based tourism. Bhutan has enhanced its ecotourism income by limiting supply: there are visitor quotas and each tourist is required to sign up with one of the country's certified tour agencies. These agencies coordinate with each other to ensure that facilities are not overcrowded, and that everyone shares the revenue (Kohler *et al*, 2015).

Viafier retica
Ferrovia retica

Smart Valley Val Poschiavo Switzerland
©Valposchiavo Turismo

Purpose-driven ecotourism and community-based tourism can bring benefits to both people and nature, unlike asset-oriented models (Foggin, 2020). Ecotourism can also strengthen community conservation efforts, thereby helping the country to meet national goals, obligations and aspirations.

Food & tourism for mountain development

Worldwide, the tourism sector has shown an ever-increasing interest in traditional and high-quality foods in recent years, and in the local agriculture systems that generate such products. Robust and vibrant food systems, together with well characterized gastronomic heritage, have in many cases contributed to increased incomes for local communities through both national and international tourism. Food systems can act as an incentive for international tourists, even when the main rationale behind visiting a country is not gastronomy, while domestic tourism can stimulate the transfer of wealth from cities to rural towns and from richer to more vulnerable areas.

In collaboration with the Coalition of Fragile Ecosystems, Slow Food and the Department of Tourism of the Philippines, the MPP initiative launched the Food & Tourism for Mountain Development project in 2018, which promotes sustainable food systems as drivers of sustainable tourism. The project aims to create stronger synergies between mountain food products and sustainable tourism services in the Philippines' Cordilleras region. This includes promoting high-quality, indigenous mountain food products and helping vulnerable mountain communities to tap into rising demand for sustainable, fair-trade, quality food. The Cordilleras is the most mountainous region in the Philippines. It is also one of the poorest and most marginalized,[7] with poverty levels that exceed 40 percent – twice as high as the national average. The project connects small-scale producers with tourism service providers, helps to promote high-quality mountain products, and allows visitors to discover and support unique biodiversity, while safeguarding indigenous foods and boosting the local economy.

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[7] Poverty Statistics of the Cordillera Administrative Region http://rssocar.psa.gov.ph/content/2018-poverty-statistics-cordillera-administrative-region#:~:text=The%20poverty%20threshold%20of%20the,considered%20not%20poor%20in%202018.

Rice farming in Ifugao Province, Philippines
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Conclusion

Mountain agriculture plays a critical role in the livelihoods of mountain communities and those of people living downstream. The case studies presented here highlight the rich diversity of mountain farming systems, as well as the solutions that they offer for sustainable mountain development and their relevance for achieving the 2030 Agenda for Sustainable Development.

Mountain farming systems have developed throughout the centuries and have proved to be resilient and highly diversified. They can benefit significantly from a transition to agroecology, especially where environmental degradation and unsustainable resource use are threatening the sustainability of mountain agrisystems.

The experiences showcased in this publication demonstrate that the 10 Elements of Agroecology are highly relevant for mountain farming systems. These are:

Diversity, which improves mountain soil health and productivity, and can also help to bolster nutrition and human health and market diversification, ultimately building resilience.

Co-creation and sharing of knowledge processes that blend mountain traditional and indigenous knowledge, as well as producers' and traders' practical knowledge and global scientific knowledge.

Synergies that contribute to enhancing key functions across food systems are particularly important in mountain contexts, where ecosystems are fragile and harmony between agriculture and nature is crucial. Practices such as innovative high-biodiversity cropping systems (including animal integration and high-value crops) also reinforce other principles, such as **efficiency, recycling** and **resilience.**

Human and social values and **culture and food traditions** that can help to promote cultural preservation and sustainable mountain tourism development, and to foster the strong sense of belonging and traditions in mountains.

Responsible governance and a **circular and solidarity economy** that can be considered as potential responses to the widespread lack of targeted mountain-specific actions and projects, lack of access to infrastructure and markets and lack of organized support, and help to create an enabling environment that promotes sustainable food systems.

This publication showcases viable solutions for recovery programmes based on the SDGs for long-term sustainable development, in particular in marginal environments. Mountain agriculture has the potential to advance sustainable mountain development and strengthen the resilience of communities and ecosystems in mountain areas, contributing to the SDGs.

The Decade of Family Farming (2019–2028) has a particular resonance for mountain communities. It seeks to promote the design and implementation of comprehensive economic, environmental and social policies for a conducive environment to strengthen the position of family farming. By working together and within organizations (locally, nationally and internationally), mountain farmers can achieve stronger representation in relevant policy processes. Governmental and private sector institutions can provide incentives and create enabling environments.

In many countries, national family farming secretariats are leading the development and implementation of Decade of Family Farming strategies. By taking steps to ensure that they are closely involved in national family farming secretariats, mountain farmers and their organizations have an important opportunity to make certain that mountain areas are incorporated in such strategies. If required, international organizations and NGOs could facilitate capacity development of mountain farmers and their organizations to fulfil this role. Securing the involvement and adequate representation of mountain farmers in global farmers' organizations represented on the Decade of Family Farming International Steering Committee (such as the World Farmers Organization, the World Rural Forum and La Via Campesina), would be a valuable opportunity for mountain development.

As the only United Nations voluntary alliance of partners dedicated to improving the lives of mountain people and protecting the world's mountain environments, the Mountain Partnership plays a fundamental role in supporting mountain farmers worldwide, and it is fully committed to promoting the agroecology approach.

Through adequate and coordinated pro-mountain policies, investments, capacity development, services and infrastructures, as well as efforts to provide smallholders and family farmers with access to innovation, mountain farming systems have the potential to become important pathways for change. In so doing, they can provide valuable support and impetus to the transition to sustainable food systems, contributing to revitalizing rural areas for youth and lifting mountain peoples out of poverty and hunger, while protecting fragile mountain environments for the future.

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Energizing mountains – Solar power for organic Nepali apples

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Organic family farming helps to protect watershed in Panama

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The Carpat Sheep project in Romania – It all starts with the grass!

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Smart and organic – A Swiss valley stakes its future on sustainable territorial development

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Organic cinnamon cooperative discovers strength in numbers in Viet Nam

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Chapter 6. Promoting a people-centred approach for the inclusive and sustainable development of mountain agro-ecosystems

Recognizing the value of connecting culture and agriculture

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Sustainable wild plant collection – A driver of rural change in the Armenian mountains

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Stingless bee honey for Bolivian ecosystems conservation

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Biological and anti-erosion measures to improve livelihoods in Moroccan watersheds

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Community-led conservation in Peru's Potato Park

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Tradition lives on in Portugal's Barroso Agro-Sylvo-Pastoral System

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Agroecology farming for sustainable community land-use management in Sierra Leone

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Conserving an ancient agroforestry system on the slopes of Mt. Kilimanjaro, United Republic of Tanzania

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Organic vegetable production promotes sustainable livelihoods for Thai hill tribes

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This publication presents a collection of case studies by Mountain Partnership (MP) members from around the world, highlighting experiences of agroecological mountain farming systems. It aims to increase attention toward agroecological principles and approaches and showcase their potential.

The MP, the only United Nations global voluntary alliance dedicated to sustainable mountain development, is fully committed to promoting actions that can improve the resilience of mountain people and environments.

In mountains, the practice of agroecology and the conservation of agrobiodiversity results in more resilient agricultural and food systems. Sustainable mountain farming systems can drive progress towards reducing rural poverty, contributing to zero hunger and ensuring the resilience of mountain communities while maintaining the provision of global ecosystem services, especially those related to water.

Food security in mountains is a matter of concern. Through adequate and coordinated pro-mountain policies, investments, capacity development, services and infrastructures, as well as efforts to provide smallholders and family farmers with access to innovation, mountain farming systems have the potential to become pathways for change. In doing so, they can provide valuable support and impetus to the transition to sustainable food systems, contributing to revitalizing rural areas and lifting mountain peoples out of poverty and hunger, while protecting fragile mountain environments for the future.

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